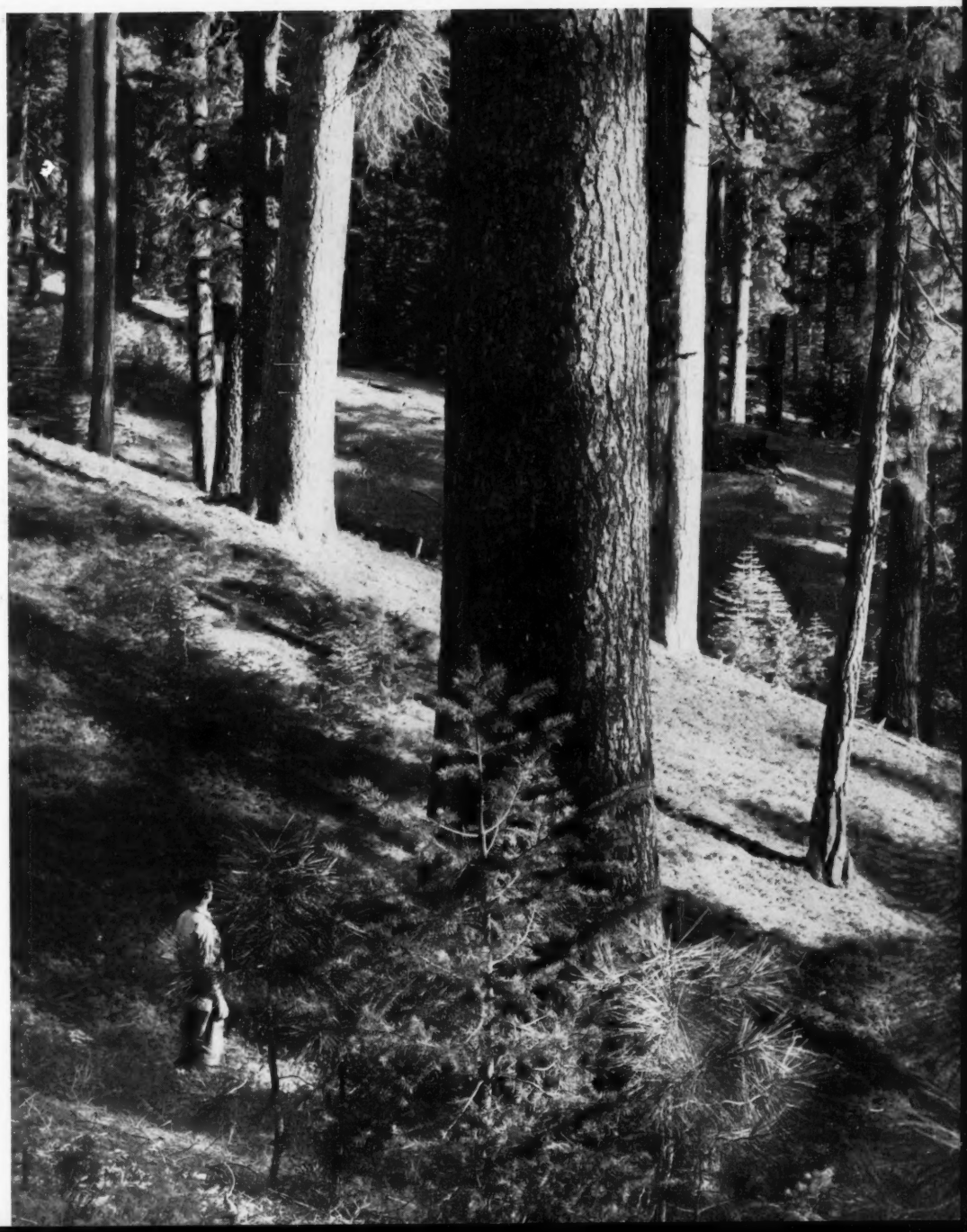
Journal of FORESTRY

APRIL 1958



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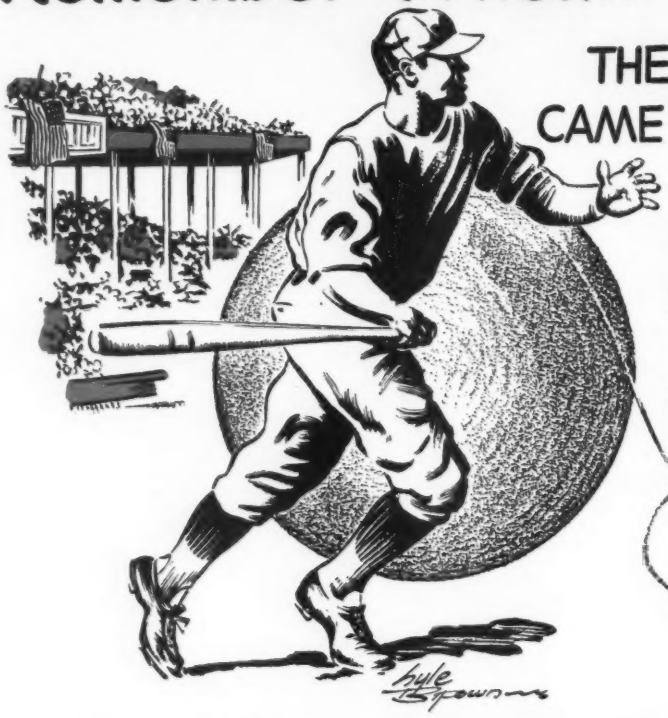

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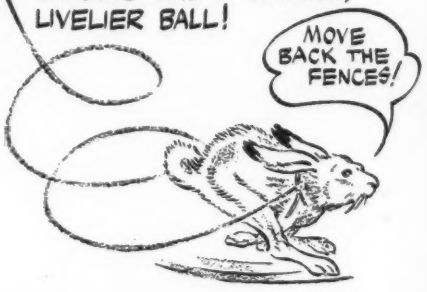

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Photo courtesy U. S. Forest Service. By R. Wilson

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Journal of Forestry

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John Sutter, Lumberman

C. Raymond Clar
California State Board of Forestry, Sacramento

The discovery of gold in 1848 on the American fork of the Sacramento River in California, the subsequent mass migration of the "forty-niners" from the East, and the influence of the gold rush on the settlement of the West are well-known episodes of American history. But usually obscured in the broad sweep of historical narrative is the fact that gold probably would not have been found at that particular time and place if John A. Sutter had not contracted with James W. Marshall for Marshall to build and operate a sawmill at the site. Accordingly, Sutter's search for lumber may be said to have been the spark that touched off one of the most explosive events in our national annals. The JOURNAL *publishes this paper as a contribution to forest history.*

JOHANN AUGUST SUTTER was once recognized throughout the world as the man who (according to the old song) discovered "plenty of gold on the banks of the Sacramento." Actually, gold was the Nemesis of that chameleon in politics, opportunist in business, and wishful Napoleon of the Sacramento Valley.

The story of Coloma sawmill and the gold discovery has been often told. Not so familiar are the lesser details of the life and struggles of a man who seemed to be a plaything of capricious fate. Sutter was sincere in his attempt to colonize a New Switzerland in the heart of the rich wilderness, and time has amply proved the soundness of his dream.

John Sutter was a many sided character who was generally able to adjust to circumstances. For a couple of seasons he hoped to thrive by enlisting the Indians to bring him beaver skins. Failing in this he turned to agriculture without comprehending the effect of the long rainless summers. His lot would have been difficult enough without the great forces of international politics swirling around him in a game in which he deliberately chose to play an active part. And then the gold madness overwhelmed him and his dream.

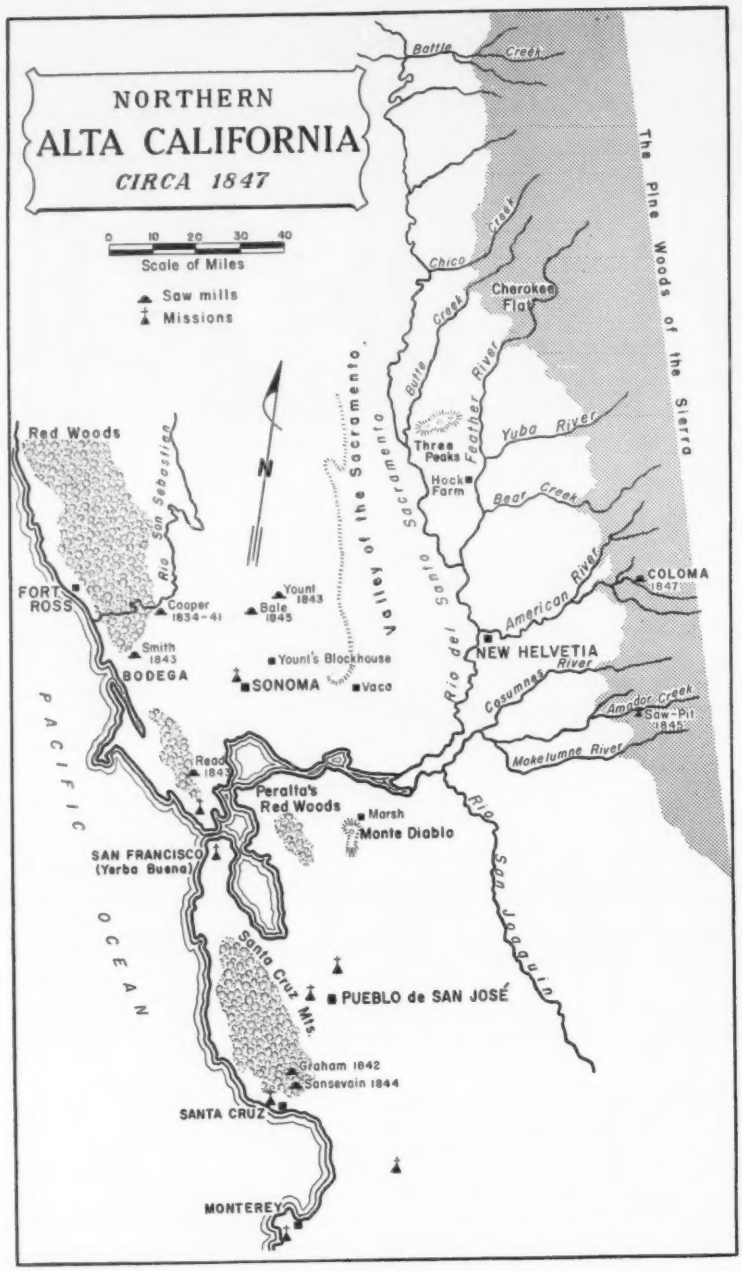
In such a story it is no wonder that heretofore no one has regarded Sutter so prosaically as to call him a lumberman. Yet the quest for lumber runs continuously through the Sutter incident.

Sutter arrived in California via the Sandwich Islands in July 1839, with a party of twelve. In view of the fact that foreigners, especially the *Anglos*, had always been unwanted in California it is remarkable that even the suave Sutter could talk himself into the largest possible land grant of about 49,000 acres. Presumably, he presented himself more as a neutral Swiss and less as an "ex-captain of the Royal Swiss Guard of France," his usual role. France, along with Russia, England, and the United States, was rightly suspected of having designs on California. But there is little doubt that Governor Juan Bautista Alvarado saw in Sutter a counterforce to his haughty uncle, General M. G. Vallejo, military *Comandante* of the province and defender of the Northern Frontier.

At any rate, Sutter received a provisional grant and promptly departed for the New Helvetia which he had never seen, and which very few of the native *Californios* had seen. As promised, Alvarado confirmed the grant at the end of a year and gave Sutter extensive jurisdiction over the area east of the Sacramento and San Joaquin Rivers. He was not to wage war without consent but he should "guard against the continuous incursions of savages and robberies and other damages caused by adventurers from the United States."

It is sometimes stated that Sutter named the American River as the anticipated gateway for American overland colonists. If true this might be regarded as a token of Alvarado's misplaced faith.

Regardless of the size of his rather vague land grant, Sutter roamed the virgin public domain of interior Alta California at his own pleasure. Such a situation has meaning only when measured against the rather conservative issuance of special privileges by the governor for the use of the national



public domain adjacent to the settled portion of the province near the ocean.

Importance of Lumber

It is paradoxical that most of the Spanish, who required so little wood in their dry land culture, had settled where timber was generally easily available in the forest or by sea transport while Sutter, influenced since birth by the superior wood craftsmanship of central Europe, found himself settled in the exact geographic center of the Sacramento Valley prairie. The land was not devoid of high vegetation. Stream courses and moist depressions supported cottonwood, alder, willow, sycamore, and the graceful valley oak (*Quercus lobata*) in dense profusion.

Although the Spanish used relatively little lumber, a commercial industry had been developing in California in the redwoods from Bodega south to the Sur River, and to a less extent in the mountains of the South. Thomas O. Larkin, the shrewd merchant (and only American consul accredited to Mexican California), developed lumber markets in the Sandwich Islands and along the entire Pacific Coast. The produce was whipsawed by hand, hewn, or split. In 1834 John Cooper, Larkin's half-brother, constructed the first powered mill in California on the unsettled San Sebastian (Russian) River near the present city of Santa Rosa. It seems quite certain that this was the only sawmill existing when Sutter arrived.

Consider now in Sutter's words (from the reminiscences called *Sutter's Diary*) the early days at New Helvetia. A small launch bearing the Kanakas, a bulldog, and the determined John Sutter, in mid-August of 1839, landed the colonists at the junction of the meandering *Rio del Santo Sacramento* and the river to be called American. Sutter tells of the first necessity of building a road from the river "through the woods where the City of Sacramento now stands . . ." and then,

> From the landing I went back about a quarter of a mile. . . In the spring I had my men make a large quantity of adobe bricks for the walls of the fort and for other buildings. I also had a quantity of lumber cut and sawed up into boards. The white men taught the Indians the use of the whip-saw and of other implements.
>
> . . . the fort was built in about 4 years of time, as it was difficult to get the necessary lumber, we was sawing by hand Oak timber.[1]

Species Utilized

It is hardly to be doubted that the first logs hoisted over the sawpit were valley oak. But this relatively soft and brittle wood must soon have revealed itself as not

[1]Throughout this article quotations follow the orthography and grammar of the original sources.

worth the work of conversion into boards or structural timbers. In fact, later records of much wood hauling from the mountains for "coalp" and "Coalpit" indicates that the low fuel value of the valley trees was also unacceptable. Long distance hauling of any cargo in the clumsy, all-wood Mexican *carretas* by ox team must have required reasonable justification even with the meagerly paid Indian labor available to Sutter.

But the low tide in lumber quality (or the high point in adapting the available), seems to have been John Bidwell's putting a couple of men to work at Sutter's Hock Farm (near present Marysville) in 1843. Said Bidwell, ". . . The lumber used was made of Cottonwood trees, sawed into planks by hand with whip-saws." He wrote that "two men would saw of good lumber about one hundred and twenty-five feet a day."

It is impossible to proceed far into Sutter's California affairs without encountering his able and devoted assistant John Bidwell. The youthful Bidwell arrived in the Sacramento Valley in 1841 with the first American immigrant train to cross the Sierra. He eventually acquired *El Rancho Chico* where the city of Chico presently stands (and also the mammoth Sir Joseph Hooker oak).

The first attempt to secure satisfactory lumber occurred with the coming of spring. The *Diary* records the following entry for 1840:

> March the 18 dispatched a party of White men and Indians in serch for pine timber and went not further up on the Amer. River as about 25 miles, found and cut some but not of a good quality and rafted it down the River.

One reasonable conclusion can be drawn from such a record. For the first time an attempt was made to convert digger pine (*Pinus sabiniana*) into lumber. Both the distance from the fort and the reference to quality tend to substantiate this conclusion.

Apparently Sutter felt thwarted in his early attempts to secure pine lumber from the Sierra. Rafting logs probably proved to be easier in theory than in practice. So in 1841 he began to deal in redwood lumber and other commodities with Antonio Suñol, merchant of Pueblo San José.

A letter (in French) headed New Helvetia, April 24, 1841, and addressed to Antoine Suñol said in part:

> Sir,
> I was very much pleased to learn through my clerk, Mr. Ridley, that you can let me have 6000 ft. of lumber; and you will greatly oblige me by having it ready on 15th prox. I shall send a large boat to get it, and also 2000 ft. purchased from Mr. Campbell. Mr. Campbell is to deliver to you on my account some beaver skins left at Doctor Marsh's house. . .

On August 2, 1841, Sutter again wrote to Suñol regarding his employee (whose name was Keyser, not Thayser). The place Keyser was to work would logically seem to have been in the Santa Cruz Mountains, possibly near the site of Stanford University.

> M. Antoine Suñol
> . . . A German named Sebastian Thayser will soon go to the Pueblo to work for some time around cattle. Later, he will saw boards and make shingles. . . So that you will know him, I have given him a note that he will present to you.

Keyser's introductory note read as follows:

> The bearer of this letter is Mr. Sebastian Thayser who intends remaining in the vicinity of San José, so as to work in the woods, Should he need anything from your store, kindly let him have what he wants and charge the amount to the account of
> Your humble servant.

Expansion

In this year of 1841 Sutter made one of his several fateful moves by purchasing the Russian property at Fort Ross and Bodega. Since their arrival in 1812 the industrious, well-behaved Russians had always been regarded as interlopers by the Mexicans. But the Russians paid little attention. They may have come to understand the meaning of Yankee Manifest Destiny but more probably the declining catch of sea otter pelts convinced them that they should retire from California.

The Mexicans, and especially Don Vallejo, were furious when Sutter purchased the Russian property by mortgaging New Helvetia as guarantee to pay $30,000 for the property (except the land which was covered in an unpublished separate deal later held to be invalid).

Assessing the value of movable goods, biographer Zollinger says in respect to $21,000 of the total, "This vast sum . . . can only be related as the lumber value of some 40 odd houses, barns, sheds, fences and stockades, some of which . . . were to stand as security. Even if one allows that lumber was expensive in California, the price Sutter paid still seems exhorbitant in view of the labor involved . . . and the great distance the material had to be hauled to New Helvetia."

But Sutter tried, and did haul some by sea and river in the 22-ton launch he had acquired in the deal and renamed *Sacramento*. He even slid one of the huge threshing rooms made of 6-inch thick hewn planks into the sea. But it foundered on the rocks before it could be towed through the Golden Gate. "Such was generally Sutter's luck."

John Bidwell was sent to Fort Ross and also to Bodega where lumber was being whipsawed for shipment by sea to Sacramento. At this lonely "Port of the Russians," Bidwell penned a rich memorandum of his early observations, including thoughts on water-driven mills in the quiet coastal and the turbulent Sierra streams. He commented that the Sierra pine must be an excellent wood although he did not know the species. As a boyhood worker in the woods of Ohio a few years earlier, Bidwell had developed an interest in trees which was reflected 44 years later when he granted land at Chico to the nation's first state forest commission for its first forest nursery site. And in less than two years hence, he was to return to this very spot, at Sutter's bidding, and fruitlessly try to stop Captain Stephen Smith from constructing the first steam operated sawmill in the West.

On July 24, 1842 Sutter transmitted another letter to Merchant Suñol at San José. By this time Sutter was heavily indebted to him.

Beaver pelts were not being brought in by the Indians and it is doubtful if Suñol was entranced by the deer tallow transmitted in small lots. But things were about to improve, said Sutter. He was then harvesting good wheat crops, and furthermore,

> In October I expect to make brandy from wild grapes, which are more abundant this year than ever before. I have also made friends with the Indians at the Feather River, who are several thousand men strong, and wish to bring me a large quantity of grapes.
>
> I have a splendid place near here for a saw and flour mill, which is to be constructed in a short time. The builder of the mill assures me that he has never seen so good a location in California. The Indians at the fork of the Feather River will supply me with fine cedar and white and yellow fir [*cedre et Sapin blanc et jaune*].

In was much too early for common names to be attached to the Sierra tree species, or even scientific names in many cases. But it is fascinating to speculate what trees Sutter could have been talking about, if indeed he distinguished between the pines and firs at all. The cedar was obviously *Libocedrus decurrens*. The other species could have been *Pinus ponderosa, P. lambertiana, Pseudotsuga menziesii* (Mirb.) Franco, and *Abies conocolor*.

Indefinite records indicate that a little whipsawing was done in the Sierra in 1843 and 1844 but it appears that during this peirod Sutter was relying on the redwood brought in by boat from Bodega, Santa Cruz, or more probably, the Oakland hills where members of the Peralta family were grant holders. On November 5, 1845, there was entered in the *New Helvetia Diary* the following:

> Started the Russian launches for Yerba Buena—started Dennis Martin for Peralta's Redwoods, he takes with him 3 boys Olel, Sholsin, and Tomcha, and is to pay 12 dollars per month.

John Bidwell wrote: "He kept his launch running to and from the bay, carrying down hides, tallow, furs, wheat, etc., returning with lumber sawed by hand in the redwood groves nearest the bay, and other supplies. On the average it took a month to make a trip."

Quest for Water Power

The search continued for a water power mill site in the Sierra foothills where good pine sawlogs would be plentiful and the finished product could be easily hauled or rafted to New Helvetia. Bidwell's biographer Royce says, "The spring and summer of 1844 were spent by Bidwell in various exploring trips, searching for a saw-mill site for Sutter and finding suitable locations for grants for various parties."

During 1845 Sutter joined forces with Mexican Governor Manuel Micheltorena to put down a rebellion led by his old benefactor Alvarado and José Castro of San José. The comic opera campaign served only to alienate Sutter from the sympathies of most *Californios* and many resident Anglo-Saxons. A further result of this incident involved about 98,000 acres of land as an extension or *sobrante* to the New Helvetia grant duly made by Micheltorena to Sutter for loyal service rendered as agreed upon.

In 1845 Sutter turned seriously to the project of whipsawing Sierra pine and hauling it to the fort. A history of Amador County states:

> The first authentic report of the presence of white men in the country was in 1846, when Sutter, with a party of Indians and a few white men, sawed lumber for a ferry-boat in a cluster of sugar pines on the ridge between Sutter and Amador creeks, about four miles above the towns of Amador and Sutter. In 1849 the remains of the timber and the sills over the pit were in good preservation though showing indications of being older than the gold-hunting immigration.

No doubt, the claim regarding Sutter being there first could be seriously challenged. Also the quoted year seems to be in error. John Bidwell later told of visiting in 1849 the place where Sutter had sent two men to saw lumber in 1845, 40 miles south of Coloma. The Sutter-to-Larkin letter quoted below is more substantial evidence.

On July 22, 1845, Sutter wrote to Larkin at Monterey, a letter rich with hope and ambition for the New Helvetia colony. As usual, things were looking up. This letter was written in English and reflects a little German accent. Note that *Capper* and *staffs* must certainly mean cooper and staves. The pumps were water conduits made by reaming a hole lengthwise through pole-sized logs. Much about the great agricultural prospects around New Helvetia has been omitted in the quotation here. Naturally, Larkin was also one of Sutter's numerous creditors.

> Thomas O. Larkin Esq.
>
> . . . A Great Advantage for the Establishment is that we have the best quality's of timber so close by, it is only 30 miles from here, where I have 9 white Men and 10 Indians employed, sawing the best kind of pine, making shingels of pine and Cedar, the pumpmaker is making pumps up there, the Capper get some staffs out, an another is getting the lumber out for three flatboats, which will be used as ferryboats, and the next year the[y] have to take heavy Cargo of Wheat on the Mouth of the River that the launches can make quick voyages to Yerba buena. In this Cedar and pine wood I intend to build a sawmill. I think this kind of lumber would sell better as redwood.

Beginning in September 1845, a diary of general activity was kept at Sutter's Fort. Numerous entries refer to lumbering and certainly it can be assumed that much of the coming and going into the Sierra foothills from Butte Creek to the Mokelumne River must have been involved with whipsawing or with continuing the search for a water power mill site. Here are a few excerpts from the *New Helvetia Diary*.

> 1845, Sep 17. Started J. Bidwell for the Pine Woods—also Thomas Tucker for the purpose of sawing.
>
> Sep 19—(arrd Thursday H. Trow from pine woods) J. Bidwell took acct of Shingles and lumber in the Pinewoods. . .
>
> Mon 22nd—Started J. Dupas for the mountains—also H. Trow for the purpose of sawing lumber.
>
> Wed 24—Arrd D. Martin from Mts. with lumber about Noon.
>
> Wed Oct 8—1 Waggon and five Carts of Lumber came today from Pine woods.
>
> Wed, Nov. 26—Arrived Petter Lassen from Yerba Buena. Started Waggon's for Pine Woods.
>
> Dec 2—Sent I Cart for timber for pump cylinders 8c gate posts—1 Cart hauling ovenwood.
>
> Dec 23—Started Sicard for Bear Creek.
>
> Dec 24—Started S. Neal for Feather River 8c Bute Creek.

Then there were three entries in November noting the starting of "Waggons for the Pine Woods." On the 29th there is this notation: "Welded Wagon tire." The first iron-tired, spoke-wheeled wagon was carried to the floor of the Sacramento Valley in the spring of 1844 after having been buried under

snow on the far side of the Sierra all winter. By 1845 Sutter seems to have had American wagons instead of California *carretas* for most of his freighting, and also wagons to sell.

The Coloma Site

John Bidwell's statement in respect to his trip with Robert Semple in the summer of 1846 must be the origin of the repeated declarations by historical writers that the Coloma site was chosen principally because it was rich in sugar pine timber. This writer believes that such a conclusion is not valid. We have no evidence that Bidwell saw the Coloma site until after the mill was constructed. In any case, it did not meet with his standards and he recommended against the project; which is to say, Sutter's 1846 specifications in dealing with Bidwell could have been lowered a year later when he was listening to the self-confident Marshall.

At any rate, Bidwell and Semple went up the North Fork of Feather River to the vicinity of Cherokee Flat. Semple wished to recommend the site in spite of little sugar pine and the water too rough for rafting lumber with reasonable success. They disagreed and parted company.

This was the time of violent political change. The Bear Flag uprising occurred at Sonoma on June 14. General Vallejo was made a prisoner and held at Sutter's Fort, with John Sutter acting as congenial jailer. By this action it has been charged that the ubiquitous John C. Frémont hoped to provoke the Californians into open combat. By July 7, Commodore Sloat had taken final and official possession of California. On August 15, Robert Semple with Walter Colton (first American judge) started printing at Monterey the region's first newspaper.

Through the hurly-burly, Sutter was still interested in establishing a sawmill. The idea of damming the American River at Brighton and constructing a flour mill was paramount. To quote Bidwell further:

Sutter's many enterprises continued to create a growing demand for lumber. Every year and sometimes more than once, he sent parties into the mountains to explore for an available site to build a sawmill on the Sacramento River or one of its tributaries, by which lumber could be rafted down to the fort. There was no want of timber or water power in the mountains, but the canyon features of the streams rendered rafting impracticable. The year after the war (1847) Sutter's needs for lumber were greater than ever, although his embarrassments had increased and his ability to undertake new enterprises became less and less. Yet, never discouraged, nothing daunted, another hunt must be made for a sawmill site. This time Marshall happened to be the man chosen by Sutter to search the mountains. He was gone about a month and returned with a most favorable report.

James Wilson Marshall was a wagon builder and able artisan who had drifted down from Oregon and stopped to work at the fort. He and others were constantly searching for a satisfactory mill site as far south as the Mokelumne. About May 20, 1847 Marshall and party entered the sheltered Coloma Valley on the South Fork of the American and determined that here at last was the spot. Sutter agreed. But the search still went on. Consider the statement of Mrs. Wimmer. She went up from the fort to Coloma with the first work party, which included her husband, on August 28, 1847. She was to be the camp cook. Declared Mrs. Wimmer, "In June, 1847, they loaded all our household plunder for Battle Creek, up on the Sacramento, to put up a sawmill, but they changed their plans and went to Coloma."[2]

Perhaps Bidwell was unduly sensitive about his own failure to find a site over the years. The idea that lumber could be floated down the rugged canyon of the American (even after a planned 18-mile haul) seemed preposterous to him. The fact that Marshall intended to float his half of the cut on down to the new village of San Francisco was not his concern. Bidwell later wrote that only Marshall, who "was certainly eccentric and perhaps somewhat flighty" would have "ever entertained so wild a scheme . . . and no other man than Sutter would have been so confiding and credulous as to patronize him."

The Mill in Operation

Nevertheless, Bidwell drew up the contract agreement between Sutter and Marshall. Larkin was persuaded to furnish necessary irons and tools. In high hopes again Sutter wrote to Larkin on October 29, 1847: ". . . The sawmill will be in operation in about 4 or 5 weeks and shall be able to supply the market with the finest of pine lumber the next spring or summer."

When the mill was finally constructed after great difficulties, Bidwell did not hold back in his praise for Marshall's excellent work.

A small sidelight on the unwritten terms of the partnership between Sutter and Marshall reflects one of the business hazards of that frontier and the agility of Sutter to make plans for landing on his feet in any event. The Mexican War was not settled at this date and it was planned that the partnership arrangement would continue with either Sutter, the naturalized Mexican, claiming the land or Marshall, the American, depending upon the turn of the coin. However, Sutter was sharp enough immediately to grasp the fact that odds were overwhelmingly against either of them holding the site after he had identified as gold the nuggets Marshall brought down to the fort that fateful afternoon of January 28, 1848.

To meet this emergency Sutter negotiated with the local Indians for a lease on the land, a proposition which no doubt surprised them if they really knew what they were doing. But the interim American military government refused to validate Sutter's lease document on the grounds that it lacked such authority.

The well constructed mill was operated by an undershot or "flutter" water wheel which pushed a sash or "up and down" saw in

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[2]From an interview published in *Daily Evening Bulletin*, San Francisco, December 19, 1874. The term plunder commonly referred to household goods among the overland immigrants.

vertical motion. Probably it sawed no more than 1,000 feet a day. Only a few thousand feet were produced by the partners before the mill succumbed to gold fever and was forced to cease operations on May 16. Nevertheless, Sutter could rejoice in the culmination of the long quest for pine lumber sawed by his own power mill when a few planks arrived at New Helvetia by the end of March 1848.

The demand for lumber around Coloma naturally increased because of the influx of miners. Sutter sold his share of the mill for $6,000 and Marshall sold a third of his half interest. Under a new partnership the mill went into production from December 1848 until it shut down permanently in May 1849 for lack of logs. A few brief records indicate that lumber sold locally for $300 to $500 a thousand feet. Of course, the miners helped themselves to timber as they pleased, with as much legal right as the mill operators. And much forest destruction by wildfire must have been inevitable under the prevailing conditions of uncontrolled land use by a wandering, ungoverned population of miners.

At any rate, the "apparently inexhaustible quantities" of timber on the surrounding hills as pictured by Marshall's enthusiastic biographer, George F. Parsons, were anything but that. This was especially true in terms of log transportation facilities of that day. Originally, the Coloma Valley undoubtedly supported some fair quality ponderosa pine, with intermingled spots lacking in timber just as it is today. Shallow or inferior soil is indicated by some of the local plant species. The area is presently classified as Site III timberland. Probably a strip of better soil near the river was once Site II.

In 1886, the newborn State Board of Forestry employed an engineer who mapped the then existing lower boundary of timber just about where it would be placed today, that is, a couple of miles east of Coloma Valley. He also made the statement (without recorded evidence) that "timber fit for sawing is now twelve to fifteen miles east of its original location."

Such an assumption seems most logical in view of the fact that most of the vulnerable lower vanguard of coniferous timber along the Sierra front must have consisted of fingers down the canyons and in sheltered pockets, similar to Coloma Valley.

The existence of sugar pine in that vicinity is something else again. None grows there now. But at least one old resident declares from personal knowledge that several large sugar pine trees have been cut there. At approximately 750 feet elevation the site is too warm and dry even where soil conditions might be acceptable to the fastidious queen of the western forest. On the other hand, it seems entirely logical that on that spring day so long ago, James Marshall looked about him in *Colluhmah*, the "beautiful vale" and was well satisfied with the sufficiency of mature ponderosa pine growing within a few hundred feet of the swift, sparkling river.

Henry Bigler, one of the construction men, left an excellent description of the original vegetation at Coloma (from Neasham's notes, *Diary of a Morman*, MS, Utah Hist. Soc.): "The country around the mill sight looked wild and lonesome surrounded by high mountains, on the south side of the River the mountains were densely covered with pine, Bolsom, Pinion pine, Redwood, white oak and low down the live oak while on the north side there was not much timber the mountains more abrupt and rocky covered in places with patches of Chimmesorl and greeswood. Country infested by wolves, grizzly bears and Indians."

The fact that he distinguished between pine and digger (his Pinion) pine lends weight to the theory that only two species of pine were present. It would seem that the desirable sugar pine would have registered in this listing of six tree species if it were present. Bigler's redwood was surely incense cedar. It seems unquestionable that the *Bolsom* was Douglas-fir and not white fir. Although the former does not presently appear near the site it would not find Coloma an unusual habitat.

The End is Failure

After the gold discovery had provoked a popular stampede the errant career of John Sutter was subject to even more violent change. Neither he nor Marshall seemed to possess the personal qualities necessary to take advantage of opportunity and luck. A locust horde of squatters invaded most of Sutter's holdings; yet sometimes he rode the whispy clouds of artificial grandeur. More often he tasted defeat and despair.

In 1880, practically destitute, John Sutter, empire builder and erstwhile lumberman, died. Let the closing words of his Diary reflect his melancholy fate: "I think now from all this you can form some facts, and that you can mention how thousands made their fortunes from this Gold Discovery produced through my industry and energy (some wise merchants and others in San francisco called the building of this Sawmill another of Sutter's folly) and this folly saved not only the Mercantile world from Bankruptcy, but even our General Govt. but for me it has turned out a folly, then without having discovered the Gold, I would have become the richest wealthiest man on the Pacific Shore."

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Longleaf Pine Seed Dispersal In South Alabama

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WHAT IS THE effective seeding range of longleaf pines (*Pinus palustris* Mill.)? The size of forest openings and the width and orientation of clearcut strips that can be seeded from adjacent longleaf timber all depend upon the seed dispersal characteristics of the species. Uniformly successful natural regeneration of longleaf will require the best possible utilization of a generally scanty seed source. This cannot be attained without a good working knowledge of seed dispersal patterns.

At present, little is known about longleaf seed dispersal. An early observer (*3*) found 140 feet to be the average maximum distance of longleaf seed flight from a seed tree. This observation was based on established seedlings rather than the fall of seed. Another noted that longleaf seed generally falls within 50 feet of the parent tree (*1*). Bryant (*2*) set the maximum distance of longleaf seed distribution at 1½ times the height of the tree, and the limit of effective seeding at a distance no greater than the height of the tree. Normally, regeneration is confined to a narrow strip at the timber's edge, and satisfactory regeneration as far as 500 feet from a wall of longleaf timber will depend upon an unusually heavy seed crop combined with a favorable seedbed (*4*) and strong winds from the right direction.

To secure more precise information on longleaf seed dispersal, a study was established in 1955 on the Escambia Experimental Forest in South Alabama. The site was an 80-acre clearing in a second-growth forest of 40- to 60-year-old longleaf pine.

Methods

The four walls of timber surrounding the clearcut eighty acres were oriented in the four cardinal directions. Two transects of square, quarter-milacre seed traps were established at right angles to each of the four forest walls. Each transect consisted of 15 traps, spaced half a chain apart, commencing ½ chain inside the wall and extending 6½ chains into the clearing (Fig. 1).

Trapped seeds were counted weekly from October 17 to December 26, 1955, and soundness was determined by cutting tests. Traps were checked far enough before

FIG. 1.—*Left:* Wall of longleaf timber next to a fresh clearcutting. How wide a strip can be regenerated by seed from the wall? *Right:* One of the eight transects of seed traps.

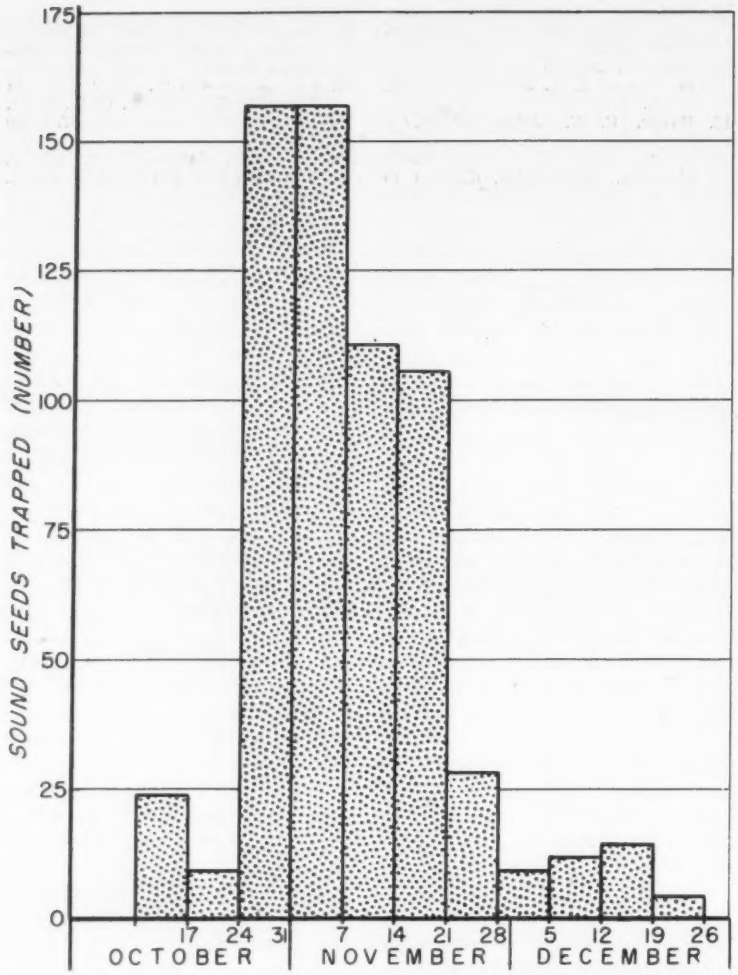

FIG. 2.—Time of longleaf seedfall, 1955. Each bar represents the number of sound seeds caught in 120 quarter-milacre traps.

and after these dates to determine the full duration of seedfall.

Time of Longleaf Seedfall

The 1955 seedfall on the Escambia Experimental Forest lasted nearly four months. The first sound seed was trapped on October 14, and the last had fallen by February 6. Eighty-four percent of all sound seed fell during the four weeks from October 24 to November 21; half of all sound seed trapped fell in the two weeks following October 24. Figure 2 shows the amount of sound seed caught in all traps during the week preceding each examination. It can be seen that seedfall started in earnest during the week of October 24 to 31 and declined rapidly after November 21.

TABLE 1.—STAND AND CONE-COUNT DATA[1] AS RELATED TO SOUND SEED TRAPPED INSIDE FOREST STAND

Wall	Basal area per acre	Mean d.b.h.	Average height of dominants	Seed trees per acre	Cones per average tree	Sound seeds per acre inside forest wall
	Square feet	*Inches*	*Feet*	*Number*	*Number*	*Thousands*
North	42.1	10.3	59	70	20.0	76
East	23.9	9.7	53	45	27.7	58
South	47.5	11.7	58	62	35.1	80
West	45.1	10.7	59	69	48.3	204
Average	—	—	—	—	—	104

[1]Stand and cone-count data from 0.6-acre sample at each transect; samples included only trees 8 inches d.b.h. and larger, plus cone-bearing trees less than 8 inches d.b.h.

Amount of Seed Dispersed

Directly under the forest canopy, seedfall averaged 104,000 sound seeds per acre, but the amount trapped varied widely among the four forest walls. About 47 percent of all sound seed trapped came from the west wall. The south wall produced about 27 percent, the north wall 17 percent, and the east wall 9 percent. Cone counts related this large variation to differences in seed production. Stand differences could explain the low seed-production of the east wall, but not the variation among the north, south, and west walls. These three stands are similar in basal area and seed tree size (Table 1). No good hypothesis can be advanced as to why the west wall had so many more cones and seeds than the north and south walls.

Distance and Direction of Dispersal

Sixty-six percent of all sound seed trapped fell under the forest canopy, and an additional 23 percent fell within 1 chain of the forest wall.

Dispersal generally followed an exponential curve in the rapid decrease in seeding rates with increasing distance from the forest wall. Seed counts were averaged for all four walls in order to use all the data and minimize directional influences. The amount of sound seed trapped was approximately halved with each successive half-chain distance from the forest wall. This dispersal can be translated to the formula $Y = \frac{A}{4^x}$, in which Y = seeding rate of sound seed in thousands per acre, A =

average seeding rate inside the wall in thousands per acre, and x = distance from the wall in chains. Transformed to logarithms, the formula becomes Log Y = Log A − 0.6021X. The untransformed formula is plotted in Figure 3 with $A = 104$. Seed-trap data are shown as individual points for all trap distances from 0 (average of traps at and ½ chain inside the walls) to 4½ chains beyond the forest wall. The chart shows the close relationship between the points and the curve. Points more than 4½ chains (297 feet) from the wall are not shown because only five sound seeds were trapped beyond this distance.

The figures above are averages for all walls; the individual walls differed in performance. At distances of 1 chain or more from the timber, the south wall achieved seeding rates nearly equal to those of the west wall, even though the latter produced more than twice as much seed. To check the possibility of some directional influence, dispersal from each wall was expressed as a percentage of all seed trapped at that wall.

On this basis, the best dispersal of seed was attained by the south wall, with a total of 47.9 percent of trapped seed falling in the clearing (Table 2). The north wall followed, with 38.5 percent of its seed projected beyond the wall.

The important point in these observations is the very limited distance of longleaf seed dispersal into the clearing. If it be assumed that 15,000 sound seeds per acre are the minimum to achieve satisfactory stocking, then only the south and west walls met this standard at 1½ chains distance. Both walls fell below the standard at 2 chains, even though the west wall produced over 200,000 sound seeds per acre under the forest canopy.

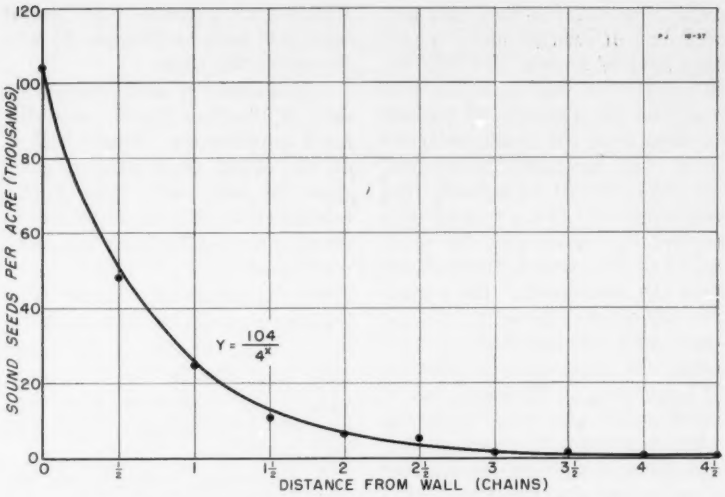

FIG. 3.—Longleaf seed dispersal, 1955, average for all walls.

TABLE 2.—PROPORTION OF SOUND SEED TRAPPED WITHIN AND BEYOND THE EDGE OF FOREST STANDS

Wall	Sound seed trapped at various locations				
	Under wall	½ to 1½ chains	2 to 4 chains	4½ to 6½ chains	Total outside wall
	Percent				
North	61.5	29.4	8.2	.9	38.5
East	86.4	6.8	5.1	1.7	13.6
South	52.1	37.7	7.8	2.4	47.9
West	71.6	23.3	4.4	.7	28.4

Seed Soundness

A total of 1,449 seed fell into the 120 quarter-milacre seed traps between October 14 and December 26, 1955. Of these, 631, or 43.5 percent, were sound and presumed viable. Soundness varied consid-

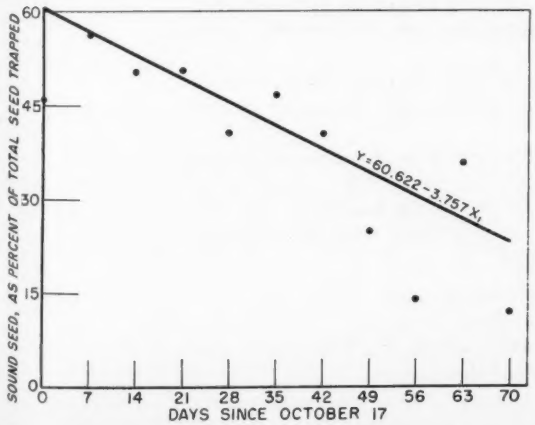

FIG. 4.—Decrease of seed soundness with passage of time after first seed was trapped on October 17, 1955.

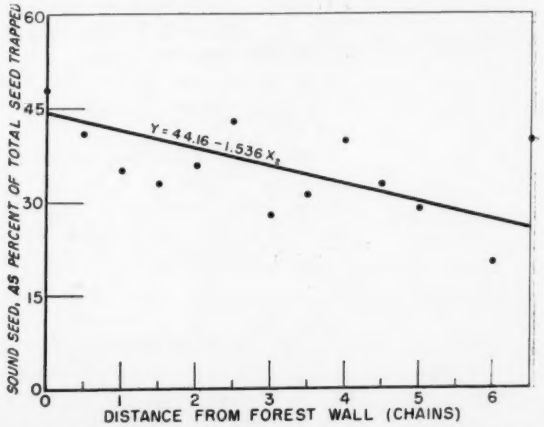

FIG. 5.—Decrease of seed soundness with distance from forest wall.

erably from wall to wall and also with date of seedfall and distance from the seed source. The high was 49 percent for seed from the west wall, and the low was 38 percent for seed from the south wall; the north wall averaged 39 percent, and the east wall 45 percent. The proportion of sound seed also trended downward with the progress of the season and with distance from the forest wall. The regression of average percent (Y) of sound seed (dispersed beyond all walls) on days since October 17 (X) is shown in Figure 4, and is highly significant at the .01 level.

The regression of average percent of sound seed (Y) on distance in chains from the forest wall (X_2) is shown in Figure 5, and is significant at the .05 level. Data for traps inside and at the edge of the wall were averaged.

Summary and Conclusions

A seed-trap study was established in South Alabama to determine how far, how many, and in what direction longleaf pine seeds are dispersed into clearcut areas from nearby walls of timber.

Seedfall commenced October 14, 1955, and ended February 6, 1956. Eighty-four percent of all sound seeds fell between October 24 and November 21, 1955.

The amount of seed trapped at each of the four forest walls differed considerably. Nearly half of all the sound seeds trapped came from the west wall. Cone counts related most of this disparity to unexplained differences in cone production.

The number of sound seeds trapped was halved with each increase of 33 feet from the forest wall. The "effective" seeding range (15,000 sound seeds per acre) was less than two chains from the best wall sampled.

A directional influence was apparent. The south wall dispersed the highest proportion (48 percent) of its sound seed into the clearing. The north, west, and east walls dispersed 38, 28, and 14 percent respectively of their sound seeds into the clearing. These differences are probably due to prevailing winds during seedfall.

Seed viability, based on a cutting test, averaged 43.5 percent, but ranged from an average of 49 percent for the west wall to 38 percent for the south wall. Soundness decreased with distance from the forest wall and also with the passage of time.

Although these results are based on observation of a single year's longleaf pine seed crop in one particular stand, it seems likely that the trends indicated might be repeated even though different years and different stands would vary in total seedfall. Especially worthy of note is the observation that the zone of seedfall generally accepted as adequate for natural regeneration (15,000 sound seeds per acre) extended only 1½ chains into clearcut openings even where more than 200,000 seeds per acre fell on the ground inside the stand bordering the clearcutting.

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Aerial Appraisal of Damage by the Spruce Budworm

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Two methods—direct aerial observation and airphoto interpretation—have been tested and compared. Both are useful, but accuracy depends greatly on the skill and experience of the personnel used.

VARIOUS METHODS of direct aerial observation have been developed for mapping and classifying forest insect infestations. The two methods generally employed—sketch mapping and line-strip surveys—have been used successfully for detecting nearly all types of insect feeders and associated damage. Research has increased the efficiency of aerial surveys; and all but the most intensive projects have been reduced in cost to less, usually much less, than $1 per 1,000 acres (*3, 4, 7.*)

Recently, aerial photography has proved useful as a means of detecting and appraising insect damage that characteristically shows itself in off-color foliage. Thus far, tests have been concerned largely with tree injury and mortality caused by bark beetles (*7*) and terminal feeders such as the white-pine weevil (*1*). The accuracy of damage estimates by experienced photo interpreters has been comparable to that obtained by intensive, and far more expensive, ground methods.

The study reported here[2] was designed to discover which of these two methods—aerial observation or airphoto interpretation—is best for assessing spruce budworm damage in the northeastern states. In particular, the study was aimed at determining how early and how accurately the initial stages of an outbreak could be recognized and evaluated by each method. The conclusions and recommendations presented are based not only on the findings of this study, conducted in 1953, but also on the experience gained before and since then in aerial surveys of budworm damage in northern Maine. Also, definitions are given here of the classes of defoliation now used for aerial budworm surveys, plus a brief outline of the factors affecting the appearance from the air of attacked stands. The study was concerned only with, and the conclusions and definitions pertain only to, budworm infestations prior to the peak of outbreak.

The Study

Study area.—The area chosen for appraisal was located in Township 16 Range 4 in northeastern Aroostook County, Maine. It comprised approximately 7,000 acres and included the drainages of three small streams feeding into Madawaska Lake (Fig. 1). Cut over lightly about 40 to 50 years ago for white pine and spruce logs, the area in 1953 represented a fairly typical cross-section of old-growth fir and spruce. The major species present was balsam fir, although its occurrence in individual stands varied from 10 percent to nearly 100 percent.

Budworm infestation in this area first became noticeable in 1948. In the next five years the population increased steadily; heavy feeding on fir was recorded in the southerly portion in 1951, 1952, and 1953. In the latter year, all degrees of defoliation of current shoots were found; and some top-killing had occurred in stands that had undergone two to three years of heavy feeding. Though tree mortality due to the budworm had occurred, a considerable number of fir trees were dead from other causes, principally from girdling by porcupines and bark stripping by bears. The tops and trees killed that year by porcupines or bears were easily distinguished from budworm-damaged trees. However, the trees killed or top damaged by animals or other agents one to three years previously did resemble budworm-defoliated trees from the air. Therefore these were taken to represent budworm damage. During the study, all classes of tree conditions characteristic of the successive stages up to the peak of a budworm outbreak were present on a limited scale.

Ground plan.—To determine the relative accuracy of the aerial observation and airphoto interpretation methods, ten sample plots of 5 acres (5 x 10 chains) each were established in the study area. Each plot corner was marked by a white cloth mounted on a 3 x 3 foot wooden frame. These markers were placed above the forest canopy on large trees that had been topped for that purpose. Exact positions of the corner trees in relation to the true corners were mapped. The location of each ground plot is shown in Fig. 1.

Tree tallies, budworm counts,

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[2]Conducted jointly with the Maine Forest Service and the International Paper Co. Appreciation is expressed to Dr. H. B. Peirson, state entomologist (now retired), Maine Forest Service, and C. K. King, forest engineer, International Paper Co., for their cooperation; and to C. S. Hood, Maine Forest Service, and R. Sawyer, International Paper Co., for their assistance in the project.

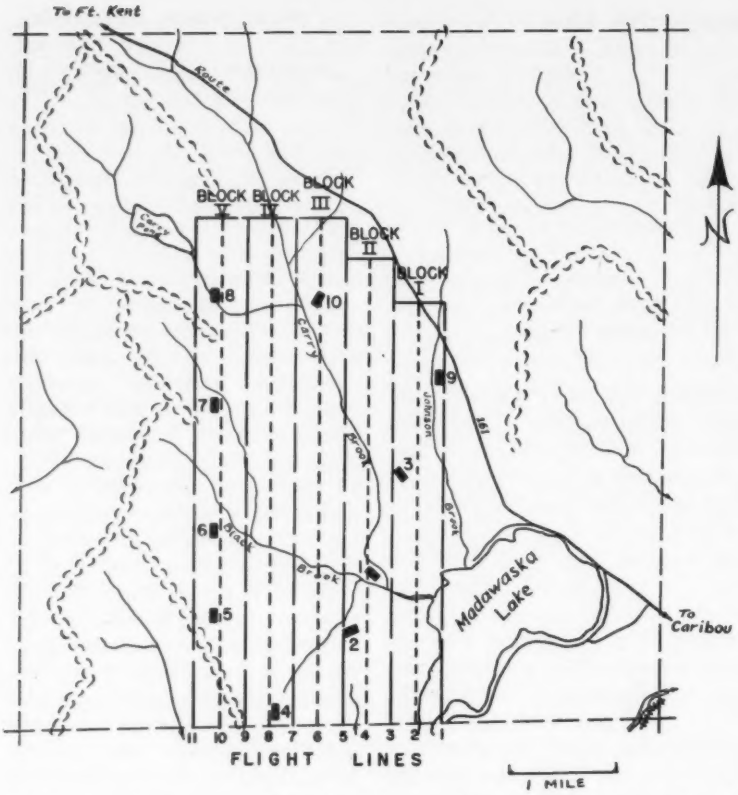

FIG. 1.—The study area at Madawaska Lake, showing the flight lines and the 10 sample plots (numbered black rectangles).

and defoliation estimates were made on the ground in each plot. All balsam fir and spruce trees 5.6 inches d.b.h. and larger were tallied by 1-inch classes as normal, top-killed, dead, or blow-down. The category "normal" included trees having defoliation but no other visible damage. Top-killed trees were further differentiated as to those with tops killed by defoliation, by girdling, or by other means. Whenever identified, the cause of injury other than defoliation was recorded. Counts of budworm larvae (4th to 6th instars) were made on 15-inch sample twigs at four stations in each plot. Five balsam fir trees were sampled per station. Sample twigs were cut from branches approximately 25 feet above the ground with aluminum pole pruners having attached cloth baskets.

Defoliation estimates were made on a sub-sample of both fir and spruce trees in the various diameter classes. For these data, each plot was considered as divided in half. Two trees per species in each d.b.h. class were taken at random in each half plot. The defoliation was recorded as 0, 2, 5, 10, 25, 50, 75, 90, 95, 98, or 100 percent of shoots for the current year. Previous studies and experience had shown that these intervals corresponded more closely than even intervals with the accuracy obtainable by direct examination of individual trees. For example, it is much easier to distinguish between 5 and 10 percent (or 90 and 95 percent) defoliation than between 45 and 50 percent, although the difference in each case is 5 percent. The averaging of these defoliation estimates gave an accurate index of defoliation for each plot.

A summary of the tree tally, the budworm population levels, and the defoliation indices of the plots are given in Table 1. As indicated, the spruce was generally larger in size than the fir. In number of trees, the fir/spruce ratio ranged from approximately 1.5 to 4.0;

TABLE 1.—SUMMARY OF SAMPLE PLOT GROUND TALLY

Plot	Trees per acre			Volume per acre			Budworms per 15-inch twig	Defoliation index		Class of infestation
	Fir	Spruce	F/S ratio	Fir	Spruce	F/S ratio		Fir	Spruce	
	No.			*Cords*			*No.*	*Percent*		
1	111.8	73.2	1.53	5.06	6.32	0.80	11.6	56	3.5	Medium
2	110.0	27.0	4.07	5.42	4.19	1.29	13.1	81	11.0	Heavy
3	138.2	42.2	3.27	6.33	4.78	1.32	10.8	96	8.4	Heavy
4	91.0	51.0	1.78	5.96	6.94	.86	1.7[1]	44	6.1	Medium
5	97.8	49.0	2.00	5.10	6.80	.75	1.7[1]	43	5.6	Medium
6	122.2	47.0	2.60	7.15	5.98	1.20	7.5	18	2.5	Light
7	109.2	48.8	2.24	7.14	8.30	.86	4.7	26	4.2	Light
8	106.2	55.8	1.90	6.72	5.94	1.13	5.6	42	4.1	Medium
9	121.8	65.4	1.86	7.56	9.77	.77	3.3[1]	66	4.8	Medium
10	121.6	48.2	2.52	6.46	6.98	.93	6.4[1]	84	4.3	Heavy
Average	113.0	50.8	2.38	6.29	6.60	.99	6.6	55.6	5.5	Medium

[1]The 25-foot sampling level was in the lower crown of most trees in these plots. In light to medium infestations the budworms are generally more numerous in the upper crown levels; therefore, the counts from these trees are lower than would be expected according to the defoliation present.

while in volume in cords, the ratio varied from only 0.75 to 1.3. The volume of spruce exceeded that of fir in six of the plots. Actual volume in trees 5.6 inches d.b.h. and over ranged from approximately 5 to 7.5 cords per acre for fir and 4 to 9.5 cords per acre for spruce. Budworm counts at individual stations in the plots averaged 0.8 to 15.0 larvae per sample twig, representing light to heavy populations. The defoliation index of balsam fir varied from 18 to 96 percent; defoliation of spruce was much lighter, averaging 2.5 to 11 percent.

Aerial plan.—The aerial phase of the study was begun when the budworms had pupated and the current feeding effects on the trees were most evident. Aerial appraisal of budworm defoliation must be timed carefully. If too early, feeding and webbing will not be completed and maximum color contrast not yet attained. If too late, many of the dead needles will have been dislodged by rain or wind and the resultant off-color will be less apparent and more difficult to gage properly.

Both aerial observation and airphoto interpretation were employed to obtain estimates of budworm damage in the ground plots and over the area as a whole. To permit a comparable sample of the entire area by both methods, 11 north-south flight lines were drawn in advance on the map (Fig. 1). These lines, scaled 18 chains apart on the ground, were then flown for both direct observation and aerial photography. Separate flights were made for each method of appraisal. The airplane used was a Cessna 195 (a high-winged monoplane) specially fitted for aerial surveys.

For the aerial observation method, budworm damage estimates were recorded directly while in flight. For the airphoto evaluation, color aerial photographs were taken at a scale and overlap that provided stereoscopic coverage. Estimates of budworm damage in the entire area and in each plot were then made from these photographs. The detailed procedure used for each method is as follows:

Aerial observation.—First, estimates of defoliation, dead tops, and dead trees were made for each plot. Defoliation was classified for balsam fir only, using three classes defined in terms of loss of current shoots as: *light,* less than 25 percent loss; *medium,* 25 to 75 percent loss; *heavy,* over 75 percent loss. Actual counts were made of dead tops and trees, both fir and spruce.

Four observers (hereafter referred to as Observers A, B, C, and D) participated in these tests. Two were relatively experienced (A and B), and two were inexperienced (C and D). Two observers were carried on all flights, one on each side of the airplane. Each was equipped with a keyboard connected electrically to an operation recorder. Thus, each observer's findings were charted continuously and independently of the other.

Each observer made three flights over the plots, being paired in turn with each of the other observers. A flight comprised two passes over every plot, one pass for the defoliation appraisal and a second for the tree-damage tally. These and subsequent flights over the whole area were made approximately 500 feet above the ground at a speed of 90 miles per hour. The observers wore orange filter masks[3] that accentuate the contrast between normal and abnormal foliage colors.

A line-strip survey was then made of the entire area by flying alternate lines: lines 1, 3, 5, 7, 9, and 11 were chosen arbitrarily. Only defoliation conditions were recorded. The observers, working in pairs, continuously recorded their appraisals of defoliation of current shoots on balsam fir as *light, medium,* or *heavy.* Two other categories, *open* and *hardwood,* were also recorded where water or clear areas and hardwood types occurred. Each observer made four flights over all flight lines, two flights scanning from the right side of the plane and two from the left side. The effective oblique scanning distance from a height of 500 feet approximates 5 chains on the ground. Thus the percent coverage by this line-strip type of survey

$$\text{was } \frac{2 \times 5}{36} \times 100, \text{ or 28 percent}$$

for the two observers recording simultaneously or for the same observer recording conditions on opposite sides of each line.

Airphoto interpretation.—For photographic coverage, color aerial photographs were taken at a scale of 1:3960 (1 inch on a photo equalled 5 chains on the ground). This gave 50 percent sidelap, which with the photo sequence timed for 60 percent overlap of successive photos, permitted stereoscopic interpretation. A Fairchild F-56 aerial camera having a focal length of 8¼ inches was used, with ektachrome aero film, size 6⅝ × 7 inches.

Budworm damage in the sample plots was interpreted first. Unfortunately, two markers on each of two plots (Plots 2 and 4) were destroyed by heavy winds the night before the photo runs were made. Rather than err as to exact plot boundaries, these two plots were omitted from the photo interpretation. The apparent defoliation was classed as *light, medium,* or *heavy* by quarter sections of the plots; i.e., each plot defoliation tally included four estimates. Counts were then made of the discernible dead tops and dead trees in the eight plots that could be outlined on the photographs. Observers A and B served as photo interpreters also, along with two additional men (X and Y).

Estimates of budworm defoliation over the entire study area were obtained from the photographs, using the method of representative simultaneous sampling described by Schumacher and Chapman (*5*). This method was essentially the same as the aerial line-strip survey, except that the sampling unit differed and a 10 percent sample was taken as compared with 28 percent for the line-strip method. More-

[3]For a description of these filter masks, see Heller, R. C. and R. C. Aldrich. Observation masks for aerial spotting of insect damaged trees. Forest Service, U. S. Dept. Agric., Washington, D. C. 2 pp. 1955.

TABLE 2.—SUMMARY OF AERIAL OBSERVATION AND PHOTO-INTERPRETATION ESTIMATES OF DEFOLIATION AND TREE DAMAGE IN SAMPLE PLOTS, AS COMPARED WITH GROUND TALLY

Plot	Aerial observation[1]								Ground tally[1]			Airphoto interpretation[1]											
	Defoliation				Dead tops				Dead trees			Defoliation				Dead tops				Dead trees			
	Obsr. A	Obsr. B	Obsr. C	Obsr. D	Obsr. A	Obsr. B	Obsr. C	Obsr. D	Obsr. A	Obsr. B	Obsr. C	Obsr. D	Defoliation	Dead tops	Dead trees	Obsr. A	Obsr. B	Obsr. X	Obsr. Y	Obsr. A	Obsr. B	Obsr. X	Obsr. Y
	Percent				*Number*				*Number*			*Percent*	*Number*	*Number*		*Percent*				*Number*			
1	23	45	19	41	1.0	3.7	3.7	3.0	6.3	8.0	3.3	4.3	56	31	17	13	50	22	13	8	9	4	11	15	13	12	6
2	80	68	88	61	.3	2.0	.7	1.3	5.3	2.3	1.3	0	81	17	5	---	---	---	---	---	---	---	---	---	---	---	---
3	88	88	88	65	0	.7	0	1.7	3.3	3.3	1.7	1.3	96	34	4	69	78	88	50	1	19	5	10	1	7	1	10
4	21	49	49	26	1.3	2.0	2.0	3.0	3.3	2.3	2.0	1.0	44	4	0	---	---	---	---	---	---	---	---	---	---	---	---
5	29	21	40	24	0	1.3	1.0	1.7	4.7	3.3	2.7	1.7	43	2	5	13	13	13	13	6	3	3	10	4	4	3	6
6	59	40	72	49	1.0	1.3	1.0	2.3	4.0	2.0	2.7	1.0	18	6	11	13	13	50	13	9	2	4	2	3	6	4	4
7	54	33	47	27	.3	1.3	.7	2.0	2.7	3.0	3.0	.7	26	11	11	59	31	41	22	5	7	0	1	9	4	3	6
8	31	21	66	25	1.0	1.0	1.3	1.3	4.0	3.3	2.0	1.7	42	12	1	22	13	13	13	2	1	0	5	9	2	6	5
9	28	28	50	53	.3	1.0	2.3	2.7	9.3	5.7	4.0	3.0	66	6	10	13	13	31	13	5	3	2	2	14	7	12	8
10	77	49	88	52	.3	2.0	1.7	2.3	4.7	3.0	2.3	1.7	84	14	5	50	31	50	13	2	0	1	1	4	3	10	4
Average	49.0	44.2	60.7	42.4	0.6	1.6	1.4	2.1	4.6	3.6	2.5	1.6	55.6	13.7	6.9	31.5	30.3	38.5	18.8	4.8	5.5	2.4	5.3	7.4	5.8	6.4	6.0
	---	---	---	---	---	---	---	---	---	---	---	---	53.9	14.5	8.0	---	---	---	---	---	---	---	---	---	---	---	---

[1]The defoliation percentages are for balsam fir only; the dead top and dead tree counts include both fir and spruce. The lower line of averages for the ground tally are based on 8 plots for comparison with the average airphoto interpretation estimates.

over, the photographic sampling method permitted a truly random selection of sample strips. The procedure is described here briefly, as it has wide application beyond spruce budworm aerial surveys.

The photo flight lines as spaced provided 50 percent sidelap. Therefore, alternate lines gave complete side-to-side photographic coverage, at least, theoretically. For this sampling method, then, the area was considered as five blocks, each block comprising the set of photos from lines 2, 4, 6, 8, and 10. The five blocks were of equal width (one photo width) but of different lengths. This block layout is shown diagrammatically on the map in Figure 1.

The 60 percent overlap of successive photos on each line provided 20 percent overlap of alternate photos, or more precisely, 10 percent on the top and bottom of each photo. Thus the alternate photos were used, and the overlap was excluded from the sample by use of a transparent template of full photo width but 20 percent (1.4 inch) less in length. The template was placed so that just 10 percent (0.7 inch) of each photo being sampled protruded above and below the template. The template was divided into twenty equal longitudinal strips; i.e., each strip was exactly 1/20 the width of the photo. Each strip was then divided into square subunits, each equal in length to the strip width. These were the ultimate sampling units, and they represented approximately 0.2 acre on the ground.

For sampling each block, or set of photos, two strips out of the twenty were selected at random (using Tippett's random numbers) to make a 10 percent sample. These same sample strips—say, strips 3 and 17—were used on all alternate photos comprising the block. The template and photos were marked so that the strips were continuous. The degree of defoliation in each ultimate unit in the two strips was then assessed and tallied. Photos adjoining each one under scrutiny were used to facilitate stereoscopic interpretation. This photo inter-

pretation for the area sample was carried out by Observers A and B only.

Results[4]

Aerial observation.—Average percentage defoliation estimates for each plot and each observer were computed from the data on the operation recorder charts. Mid-values for each defoliation class were used in the calculations as follows: *light*, 12.5 percent; *medium*, 50 percent; and *heavy*, 87.5 percent. The dead top and dead tree counts were taken directly from the recorder charts.

Analysis of these aerial data and the ground tally revealed (1) a highly significant difference in defoliation and damage among the plots, as expected, (2) a significant difference among the observers' estimates of defoliation and dead top and tree counts, (3) reasonably close agreement between the aerial and ground assessment of defoliation, and (4) highly significant discrepancies between the dead top and tree counts and the ground tally. Fewer dead trees were missed than dead tops. However, the highest aerial count of dead trees was only 66.7 percent of the total tallied on the ground, while the highest count of dead tops was a poor 15.3 percent of the ground count. These plot data are summarized in Table 2.

It is indicative, perhaps, that the less experienced aerial observers (C and D) were more extreme in their assessment of defoliation; and on the average they were less accurate in their counts of dead tops and dead trees. The latter distinction is purely academic, as the "guesstimates" of all four observers were considerably lower than the ground count. The dead and top-killed trees that were most consistently missed by the observers were of two kinds: (1) trees in the intermediate and overtopped crown classes, and (2) trees with few or no needles remaining in the upper dead portion or overall.

Table 3.—Summary of Aerial Line-Strip Survey of the Study Area, in Percentage of Area

Observer	Degree of defoliation			Type class	
	Light	Medium	Heavy	Open	Hardwood
A	18.0	42.4	32.0	1.3	6.5
B	14.4	56.7	23.2	0	5.7
C	22.6	22.4	35.2	6.0	13.8
D	42.7	29.1	14.0	1.8	12.4
Average	24.4	37.6	26.1	2.3	9.6

A quadrant sum test of the aerial and ground tally of dead trees in the plots showed no consistent correlation between the two counts. It was not possible, therefore, to derive a valid correction factor for the aerial figures. A correction factor for the aerial counts of dead tops was even less feasible, as these data were more inconsistent and over 85 percent in error.

Analysis of data from the operation recorder charts for the 28 percent aerial line-strip survey indicated a significant difference among the four observers' estimates of defoliation. This was mostly ascribable, as were the plot appraisals, to the divergence of estimates by the less experienced observers. The more experienced observers (A and B) agreed closely. The estimated average proportion of the area in the several defoliation and type classes for all observers was as follows: light defoliation, 24.4 percent; medium defoliation, 37.6 percent; heavy defoliation, 26.1 percent; open type, 2.3 percent; and hardwood type, 9.6 percent. A summary of the area estimates by the four observers is given in Table 3.

No valid estimates of the sampling errors involved could be calculated, as the sample strips for this method were fixed systematically. In practice, however, it should be possible in many cases to map and fly randomly selected lines.

Experience in this study and in subsequent aerial surveys has strongly indicated that the maximum practical coverage by this method is about 40 percent. This coverage is obtained when two viewers scan 330-foot (5-chain) swaths and the flight lines are spaced 1,650 feet apart. When flying at 500 feet above the ground, this scheme allows only about 500 feet between viewing swaths in successive lines and an unviewed swath of 500 feet beneath the airplane.

Spacing of the flight lines closer than 1,650 feet can result in inadvertent overlapping of the scanning swaths, or even crossing of flight lines. Generally, the percentage sample can be reduced—by a wider spacing between lines—for larger areas with no loss in the precision of estimates. For larger samples of small areas, some form of sketch-mapping might be more practical.

Airphoto interpretation.—The estimated average defoliation in the eight plots marked on the color photographs was determined the same way as the aerial observations. The same mid-class values were used in converting the estimates into percentage terms. The dead top and dead tree counts were taken directly from the interpreters' tally forms.

Analysis of these data showed: (1) a significant difference in the estimated defoliation and tree damage among plots; (2) a significant difference in defoliation estimates among interpreters, but no significant difference in their counts of dead tops or trees; and (3) significantly lower estimates of defoliation and counts of dead tops than the ground record, but no significant difference between the photo and ground counts of dead trees.

The statistical significance of the difference among interpreters in the evaluation of defoliation was due largely to the wide disparity between interpreters X, the most experienced, and Y, the least experienced. Although the assessment of defoliation in the individ-

[4]The assistance of Dorothy K. Thornton (now Mrs. A. T. Drooz) with the statistical computations is gratefully acknowledged.

TABLE 4.—SUMMARY OF PHOTOGRAPHIC SAMPLE SURVEY OF THE STUDY AREA

Observer	Degree of defoliation: None		Light		Medium		Heavy		Hardwood and open	
	Estimate	Sampling error	Estimate	Sampling error	Estimate	Sampling error	Estimate	Sampling error	Estimate	Sampling error
	Percent									
A	3.4 ± 1.6	47	41.8 ± 4.5	11	34.9 ± 4.3	12	9.2 ± 3.7	40	10.7 ± 1.9	18
B	2.9 ± 1.7	59	38.1 ± 2.1	6	38.9 ± 3.2	8	9.2 ± 2.8	30	10.9 ± 2.5	23

ual plots was generally lower than the ground appraisal, the averages over all plots of all interpreters, except Y, were in the range of medium defoliation, the same as the ground tally. These plot data are summarized in Table 2.

A quadrant sum test of the photo and ground counts of dead tops in the sample plots showed no consistent relationship. The same test of correlation with the dead-tree counts indicated a significant relationship (at the 98 percent confidence level), but there was wide dispersion of the values and, hence, too great an error for predictive purposes. Therefore no reliable correction factor could be calculated for the interpreted estimates of either dead tops or dead trees.

The photo interpretations of defoliation conditions over the entire area by observers A and B were in even closer agreement than their direct observations on the aerial line-strip survey. They were more conservative, however. It was found advisable, in fact, to add one more breakdown of defoliation, *none*, for sampling the photographs. The actual number of ultimate sampling units with no discernible evidence of budworm feeding was small, but it appeared necessary to include this category for a realistic comparison with the aerial observation method. Also, the *open* and *hardwood* types were combined following a discussion as to the proper classification of alder swales.

Area estimates of observers A and B from the photographs are given in Table 4. Sampling errors (2:1 odds) were computed for each observer and category. Both observers' errors were similar for all categories, but errors relating to categories differed considerably. It is apparent that the percentage sampling error for each defoliation class and type is related inversely to the proportion of the area each occupied, as would be expected.

Comparison of the two methods. —In general, the aerial observation method gave a more accurate appraisal of the budworm defoliation, while the airphoto interpretation gave a more accurate assessment of top-killing and dead trees.

It was clearly demonstrated that lighter defoliation could be perceived by direct scanning from a low flying airplane. Defoliation of less than 25 percent of the current year's shoots was easily seen at the height and speed flown.

This degree of defoliation could not be seen consistently on the color photographs. Also frequently overlooked were more severely damaged fir trees often found amid stands of lightly defoliated spruce. Vertical, or nearly vertical, photographs at even the relatively large scale used result in a general downgrading of defoliation estimates, unless the infestation is well advanced with very heavy and more or less continuous budworm feeding.

Color films with improved resolutions and aerial cameras with high speed shutters (1/1,000 second) have been developed (in 1957). These advancements produce better image definition and consequently should permit more accurate photo interpretation.

Low-level flying proved more of a handicap than advantage in counting dead tops and trees. Rapid motion and relatively large scanning area made it nearly impossible to obtain accurate counts of individual killed tops and trees. Fairly accurate counts of dead trees were obtained from the color photographs, but the counts of dead tops were still unreliable.

The aerial observation method allows more latitude in weather conditions. Flying can be conducted under cloudy or even lightly overcast skies, while clear and bright conditions are required for satisfactory color photographs. This fact would be a primary consideration where a large area has to be covered.

Experience conferred an advantage with both methods. The accuracy and consistency of appraisals were increased by familiarity with spruce budworm damage and experience in aerial observation and photo interpretation.

Time-cost analysis. — Time and costs incurred in surveying the study area by each of these aerial methods were itemized in detail. From these data, comparative figures were derived for two intensities of sampling by each—100 percent and 10 percent coverage by the photographic method and 28 percent and 10 percent by the aerial observation method.

Coverages specified for the photo technique involve sufficient photographs for stereoscopic interpretation. Costs include the color film and film development, airplane operation (at $40 per hour, equipped with aerial camera), salaries and per-diem expenses of the pilot and photographer, and photo interpretation costs.

The aerial observation costs include the operation recorder charts, airplane operation (at $24 per hour, no special camera equipment), salaries and per-diem expenses of the pilot and two observers, and transcription of the data from the recorder charts. These figures are summarized *in toto* and on a per-acre basis in Table 5.

The total time and cost of an aerial survey by either method will vary according to such factors as the size of the area, terrain, equipment, experience of personnel, accuracy desired, and so forth. An increase in the size of area involved will reduce the per-acre costs of both methods. Reduction of sample size will reduce the costs of an aerial line-strip survey approximately in proportion, whereas the costs of an airphoto survey will be decreased, but proportionately much less. Costs given in Table 5 are probably near maximum for the acreage involved; the study was conducted under strict experimental, rather than truly operational, conditions.

As indicated, the aerial observation procedure was both faster and less expensive. Though the differences between the two methods in time and actual cost might be insignificant for a small area, the saving in both items by an aerial observation survey would be considerable for a large area. For a specific survey, however, the relative costs should be balanced against the desired objectives and the accuracy obtainable in deciding which method to use.

Table 5.—Time and Cost Summary for the Aerial Observation and Airphoto Survey Methods

Method	Size of sample	Time	Total cost	Cost per acre[1]
	Percent	*Hours*	*Dollars*	
Aerial observation	28	7.0	58.12	0.0085
	10	4.7	39.08	.0057
	100	41.0	573.27	.0834
Airphoto	10	19.0	352.87	.0514

[1]Based on 6,870 acres.

Relating Aerial Observations to Ground Conditions

In the Northeast, spruce budworm populations and resultant defoliation are usually first noticed and reach highest levels on the balsam fir. Even when observations are restricted to this host species, however, certain factors tend to modify the appearance of budworm feeding and thus to obscure its true relationship to the population density. Listed below are the three accepted classes of defoliation, with brief descriptions of their appearance from the air and their relation to actual budworm defoliation and populations on the ground. The defoliation percentages specified refer to the current year's shoots.

Light defoliation.—Majority of fir trees show light browning mostly confined to the tops; occasional individual firs or small groups appear more brown. This appearance from the air may be due to the following conditions on the ground:

1. Defoliation on majority of fir trees actually *light* (less than 25 percent; budworm population *light*, averaging less than 4 larvae per 15-inch twig during the active feeding stages (4th to 6th instars); occasional trees with higher populations and more defoliation.

2. Defoliation actually *medium* (25 percent to 75 percent); budworm population *medium*, averaging 4 to 10 larvae per 15-inch twig during the active feeding stages; most of dead, brown needles washed or blown away.

3. *Defoliation actually light;* budworm population *medium;* larval feeding activity and development abnormally later than shoot development so that the proportion of new needles consumed or killed is less.

Medium defoliation.—Apparent light browning over entire crown of majority of fir trees, some green current shoots visible; occasional trees show little or no browning, others very brown with no green shoots visible. Under these circumstances the true ground conditions may be as follows:

1. Defoliation and budworm population on majority of fir trees actually *medium;* defoliation and population lighter or heavier on occasional trees.

2. Defoliation and budworm population actually *light;* increased amount and intensity of browning due to frost damage, staminate flowers, old cone axes, or drought.

3. Defoliation actually *medium*; budworm population *light;* effect of budworm feeding increased by much shortened needle growth due to concurrent flower production; or other defoliating insects (e.g., blackheaded budworm, spruce coneworm) present in sufficient numbers to have noticeable effect.

4. Defoliation actually *medium;* budworm population *heavy,* averaging over 10 larvae per 15-inch twig in active feeding stages; degree of defoliation moderated by shoot development being ahead of larval development.

5. Defoliation actually *heavy* (over 75 percent); budworm population *heavy*; some brown needles lost because of wind or heavy rain.

Heavy defoliation. — Considerable browning and/or reddish appearance over entire crowns of fir trees; few, if any, green shoots visible; occasional trees with tops bare and apparently dead; some trees with lighter browning; more grayish appearance to trees and stands that have undergone two or more years of heavy feeding, with dead tops much more frequent. This appearance from the air may be related to the following ground conditions:

1. Defoliation and budworm population actually *heavy;* some back feeding on older foliage; some trees with dead or dying tops; occasional trees more lightly infested.

2. Defoliation and budworm population actually *medium* or *light*; browning effect due to or accentuated by frost-killed tips, etc.

3. Defoliation actually *heavy*; budworm population *medium*; effect of budworm feeding enhanced by reduced foliage production due to concurrent flower growth, more back-feeding on older foliage, or increased severity of defoliation

due to associated foliage feeders.

Some Pertinent Considerations

Infestations of forest tree defoliators—and thus surveys and control operations concerned with them—generally represent an area problem, in contrast to many bark beetles and sucking insects, which tend to attack individual trees or groups of trees. Therefore, surveys from the air are especially effective for defoliators, and the line-strip technique is particularly efficient for delimiting infestations and classifying defoliation severity within the visible limits.

However, certain limitations of aerial surveys must be kept in mind. Differences in degree of defoliation among stands or localities and the visible changes from one year to the next may be more illusion than fact. Assumptions that differences in defoliation between areas represent proportionate differences in population level or that changes in the extent and severity of feeding from year to year represent real trends in population are extremely hazardous unless supplemented by ground sampling data on the actual population densities. Experience has shown that the feeding effects of a budworm population of given density may appear from the air quite different in different stands or even in the same stand from one year to the next.

Complications develop as an infestation persists. Once tree deterioration and mortality begin, it becomes necessary to describe these conditions, as well as the current defoliation.

On individual trees, damage from defoliators can range from a partial loss of foliage and consequent slight reduction in increment to outright mortality. The effects may be cumulative, or the final grim result may be achieved by the attack of only one year. Usually the effect of defoliation by a given insect is confounded by weather, disease, other insects, or other factors. Typically, there are three well-defined stages of damage by a defoliator: defoliation, top-killing, and tree mortality. The rapidity of development from one stage to the next depends on the entire complex of internal and external factors affecting the tree. Of these factors, the density of the insect population and its rate of increase are of primary importance. Qualitative and quantitative aerial estimates of the three stages or types of damage are most meaningful and reliable, therefore, when their true relation to the insect population is known.

To judge the need for control, recognition of the characteristic developmental pattern of injury to a tree species by a given insect is a critical factor in bringing economic and entomological considerations into proper perspective. In eastern Canada, mortality of balsam fir has been reported as commencing in the fifth year of severe defoliation by the spruce budworm, with complete or nearly complete mortality of trees eight years after the start of heavy feeding (*2*). Top-killing there preceded tree mortality by two to three years.

Still, budworms can kill a small tree in a single year by stripping its foliage completely. And conversely, certain areas in northern Maine have withstood light to heavy feeding from fluctuating budworm populations for a period of six to eight years with only a slight reduction in growth and a limited amount of top-killing.

Conclusions

1. Light defoliation of balsam fir by the spruce budworm, characteristic of the early stages of an outbreak, can be seen and accurately appraised by direct scanning from a flying height of 500 feet and a speed of approximately 90 miles per hour. The detection and assessment of light defoliation from aerial color photographs of a scale approximating 1:3960 is less certain and less reliable.

2. For budworm defoliation surveys, the aerial observation method is more economical as well as more accurate than the airphoto interpretation method. Moreover, it allows more latitude weatherwise in carrying out a survey. It is particularly advantageous where a large area is involved.

3. For quantitative appraisal of top-killing and tree mortality of balsam fir (by spruce budworm or other agents), the photographic method is capable of providing the more accurate data. Its accuracy might be increased by color photographs of larger scale than 1:3960, or by use of newly developed high shutter speed cameras and color films with superior image resolution.

4. The accuracy and consistency of aerial and photo appraisals of budworm damage are definitely enhanced by experience in aerial observation and photo interpretation and also familiarity with the insect.

5. Use of orange filter masks is strongly recommended for the detection and assessment of budworm damage from the air. Masks are particularly helpful in spotting dead tops and dead trees.

6. Supplementary ground surveys are requisite for proper interpretation of aerial observations. Data should be taken of the insect population, defoliation, tree damage, and, insofar as possible, the status of natural enemies, particularly parasites and disease. These ground observations need not be extensive.

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Some Experiments on the Optimum Germination Conditions for Western Hemlock (Tsuga heterophylla Sarg.)[1,2]

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THE ORIGIN AND QUALITY of seeds are important for successful reforestation. The quality of a seed lot usually is determined by its composition and viability, commonly known as purity and germination. The purity determination is rather mechanical and the identification of seeds and the sampling methods are more or less standardized. The evaluation of germination of a seed lot, however, requires skill and optimum growing conditions to obtain a representative and valid measure of its potentiality.

A review of pertinent literature reveals that three procedures have been recommended for germination of western hemlock as follows:

1. Seeds are soaked for 36 hours in water, subjected to eight weeks' stratification, then germinated at 20° C. for 3 weeks (*1*).

2. Seeds are treated with four to eight weeks prechill then germinated at 20°-30° C. with supplemental light (*2*).

3. Seeds are germinated at 11°-15° C. with or without a stratification period. The test duration is 30 days for stratified seeds and 90 days for unstratified seeds (*5*).

The Oregon State Seed Laboratory has germinated non-stratified seed at 15° C. or 20° C. with supplemental light for five weeks. Results of all the service samples submitted were satisfactory. In view of the considerable disagreement existing in the published methods and the different yet satisfactory method of this laboratory, experiments were conducted to establish a standard service testing method for western hemlock seed.

Materials and Methods

Seed lots of different ages and origins were used in this study to cover a heterogeneous population from which any method developed will be more valid than from a homogeneous population. The seed lot numbers, sources, and cutting test results are summarized in Table 1.

The important factors governing any germination test of seeds are pre-treatment, temperature, moisture, light, and medium. Among these factors, three were standardized, i.e., the relative humidity in the germinators used in the laboratory was approximately 95 percent; all the germinators used for this study were supplemented with eight hours of fluorescent light which has been proven by past experience as satisfactory; the medium for germination was river-washed sand which was observed by seed analysts in this laboratory as more desirable for the growth of tree seeds than filter paper. Thus, pretreatment and germination temperatures were the only variables studied.

Experiments were designed to determine the effects of various pre-soaking periods, various stratification periods, and different germination temperatures on the rate of germination and total germination.

The general procedure for germination of spacing 100 seeds by vacuum counter on moist sand in non-toxic plastic petri dishes, incubating at a selected temperature

TABLE 1.—SEED SOURCES AND THE RESULTS OF CUTTING TESTS

Lab. no.[1]	Source	Altitude	Location	Cutting test after lab. cleaning[2]
		Feet		*Percent*
WH54 - 1[3]	Ore. St. Bd. For.	2000	N. Santiam, Ore.	98
WH54 - 2	Crown Zellerbach Co.	450	Clatsop Farm, Wash.	99
WH54 - 3	Crown Zellerbach Co.	800	Wahkiakum, Ore.	94
WH54 - 4	U. S. F. S.	1000	Olympic N. F., Wash.	99
WH54 - 5	U. S. F. S.	1000	Olympic N. F., Wash	97
WH54 - 6	Weyerhaeuser Tmbr. Co.	------	Longview, Wash.	100
WH56 - 1	Ore. St. Bd. For.	2000	N. Santiam, Ore.	100

[1]First number designates the year collected, second number indicates source.
[2]All seeds were cleaned by a South Dakota Blower for 30 seconds with a gate opening of 25.
[3]Seeds from three trees were tested separately and the number was subdivided as a, b, and c.

TABLE 2.—TOTAL GERMINATION PERCENTAGES IN NINE WEEKS' DURATION AFTER VARIOUS PRE-TREATMENTS

Lab. no.	Strat. time	Water soaking time (hours) None	24	48	72	96	120	Ave.	
WH54-2	None	85.5	80.5	87.5	88.5	80.0	77.5	85.5	LSD .05 =
WH54-5	None	94.0	91.0	89.0	86.5	85.5	80.5		2.827
WH54-2	2 Wks.	90.0	84.5	84.0	80.0	79.5	80.0	83.9	LSD .01 =
WH54-5	2 Wks.	88.0	87.5	86.5	89.5	83.5	74.5		3.883
WH54-2	4 Wks.	91.0	85.0	84.0	80.0	83.0	74.5	83.7	
WH54-5	4 Wks.	85.5	85.5	87.5	86.0	82.0	80.0		
Average		89.0	85.7	86.4	85.1	82.3	77.8		
LSD .05 = 4.009									
LSD .01 = 5.506									

[1]Technical paper 1073, Oregon Agricultural Experiment Station.
[2]A project conducted cooperatively by the Oregon Seed Laboratory of the Agricultural Experiment Station, the Oregon Forest Protection and Conservation Committee, and the Forest Tree Seed Committee.

and counting the seedlings (2-5 cm. in length, with well developed radicle and plumule) at weekly intervals was followed. Two replications were used for each seed lot. If the total germination percentage varied between replicates by 10 percent or more, the seed lot was retested under the same prescribed conditions.

In evaluating the effect of pre-soaking, the soaking procedure was to enclose 100 seeds in a small glass vial by means of cheese cloth and rubber band, then to submerge the vial in 200 ml. tap water at room temperature for the specified lengths of time. The soaked seeds were surface dried and spread on moist sand in petri dishes. The petri dishes were placed in a germinator at 20° C. after 0, 2, or 4 weeks' stratification at 5° C.

In comparing the effect of stratification and germination temperature, stratification periods of 0, 4, and 8 weeks and germination temperatures of 15° C., 20° C., 15°-25° C., and 20°-30° C. were examined.

TABLE 3.—TOTAL GERMINATION PERCENTAGES IN FOUR TO EIGHT WEEKS' DURATION AFTER VARIOUS STRATIFICATION TIME AND AT DIFFERENT TEMPERATURES OF GERMINATION

Seed lot	Temp °C.	Stratification period None	Four weeks	Eight weeks	36 hours soaking plus eight weeks' stratif.
WH54-1a	15	79.5	92.0	91.5	
	20	91.0	92.5	89.0	85.0
	15-25	86.5	90.0	88.0	
	20-30	88.0	91.0	92.5	
WH54-1b	15	96.0	95.0	97.0	
	20	99.0	96.5	95.0	96.0
	15-25	96.0	95.0	98.0	
	20-30	98.5	93.0	95.0	
WH54-1c	15	95.5	92.0	95.0	
	20	96.5	97.0	96.5	93.0
	15-25	97.0	94.5	94.5	
	20-30	93.5	97.0	94.5	
WH54-2[1]	15	75.0	64.0	72.5	
	20	75.5	77.5	75.0	74.5
	15-25	68.5	75.5	76.5	
	20-30	71.0	78.0	77.0	
WH54-3	15	66.0	61.0	56.0	
	20	64.0	64.5	63.0	60.5
	15-25	64.0	63.0	52.5	
	20-30	58.5	66.5	53.5	
WH54-4	15	67.5	61.0	48.0	
	20	60.0	56.0	55.0	55.5
	15-25	58.5	61.0	62.5	
	20-30	62.0	51.0	57.0	
WH54-5[1]	15	59.0	43.0	45.0	
	20	54.5	42.5	49.5	43.0
	15-25	65.0	49.0	47.5	
	20-30	49.0	48.5	49.0	
WH54-6	15	94.0	95.5	93.0	
	20	96.0	93.5	93.0	95.0
	15-25	92.0	97.5	95.0	
	20-30	97.0	96.5	93.5	
WH56-1	15	94.0	98.0	97.5	
	20	96.0	97.0	99.0	97.5
	12-25	98.0	95.0	96.5	
	20-30	98.0	96.5	96.0	

[1]The higher germination result obtained from the same lots in 1955 (Table 2) may be attributed to an unfavorable storage condition.

TABLE 4.—AVERAGE GERMINATION PERCENTAGES OBTAINED FROM VARIOUS TREATMENTS OVER NINE SEED LOTS

Germination temp. °C.	Stratification period None	Four weeks	Eight weeks	Temperature mean	
15	80.7	77.9	77.8	78.80	LSD. 05 = 2.122
20	81.4	79.7	79.5	80.20	LSD .01 = 2.811
15 - 25	80.6	80.1	79.1	79.93	
20 - 30	79.5	79.1	79.9	79.50	
Strat. means	80.55	79.20	79.08		
LSD .05 = 1.836					
LSD .01 = 2.432					

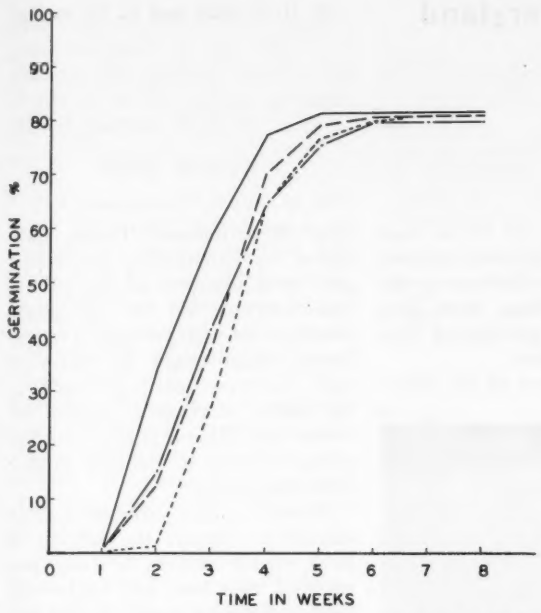
Results and Discussion

The average percentages of the duplicate samples of each lot in pre-soaking experiments are summarized in Table 2. (The data are from the records of experiments conducted in 1955 by Dr. M. C. Parker, former assistant agronomist at the Laboratory.)

An analysis of variance of the data in Table 2 indicated that the times of soaking affected germination significantly at 1 percent level and that of these times, 96 and 120 hours of soaking were detrimental. Stratification of these seed lots for two or four weeks did not significantly affect their germination.

The total germination percentages and average germination percentages from various treatments of the length of stratification and germination temperatures are summarized in Table 3 and Table 4 respectively, and the germination patterns are presented graphically in Figures 1 and 2.

The stratification and the different temperatures did not exert any beneficial effect on the total germination percentages according to analysis of variance of the results in Table 4. The method recommended by Allen and Bientijes (*1*) rendered least total germination, i.e., a mean of 77.80 percent over the nine seed lots tested. The differences between the results obtained from soaking and non-soaking seeds stratified for eight weeks and incubated at 20° C. were compared by "t" test. The "t" value was 1.856 which is not significantly different at 5 percent level. The germination response, however, did appear to be more prompt and uniform after stratification (Figs. 1 and 2). The total duration, including the stratification period in the case of stratified seed, for complete germination is least for non-stratified seeds (5 weeks compared



Legends: Germination Temperatures: - - - - - - - - - 15° C.; ——————— 20° C.; —— —— —— —— 15°-25° C.; ——— • ——— • ——— • 20°-30° C.; X—X—X—X— 36 hours presoaking. 20° C.

FIG. 1.—Accumulative germination percentages of non-stratified western hemlock seed. Each curve represents the average of nine seed lots.

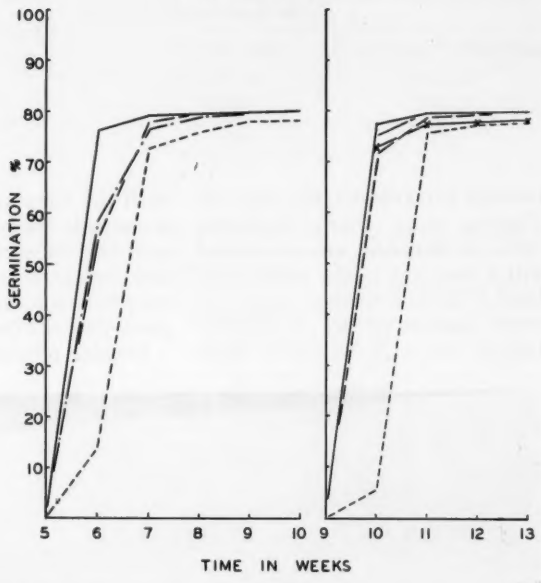


FIG. 2.—*Left*, accumulative germination percentages of western hemlock seed after four weeks' stratification at 5° C. Each curve represents the average of nine seed lots. *Right*, accumulative germination percentages of western hemlock seed after eight weeks' stratification at 5° C. Each curve represents the average of nine seed lots.

to 7 and 11 weeks for 4 and 8 weeks' stratification respectively). The specificity of germination temperature is more obvious in non-stratified seeds (Fig. 1). Regardless of the effect of stratification, 20° C. is the most desirable temperature for radicle emergence and 15° C. retards emergence as well as growth. The growth patterns at 20°-30° C. and 15°-25° C. lay between the other two extremes.

The omission of pretreatment in testing this seed is also a routine practice in the Forest Research Station in Surrey, England. Therefore, by the virtue of simplicity and rapidity which are the essence of seed testing, the optimum germination condition for western hemlock appears to be germinating seed for five weeks without soaking or stratification at 20° C. with supplemental light.

Summary

Studies were made on various lengths of pre-soaking time, periods of stratification and temperatures of incubation to determine the optimum germination conditions for western hemlock (*Tsuga heterophylla* Sarg.). Nine northwestern seed lots were used for the 388 germination tests. The results indicate that no presoaking and no stratification are needed for germination test, and 20° C. incubation temperature gives the best germination results in the shortest time.

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Red Ring Rot in Virginia Pine in Maryland

R. H. Fenton and F. H. Berry[1]

LOGGERS AND SAWMILL MEN who cut Virginia pine (*Pinus virginiana* Mill) in Maryland are acquainted with a heart rot, locally called "red heart," in this species. Since exterior indicators are frequently lacking, this rot is difficult to detect until the trees are cut or the logs are sawed. Since extensive rot can spell the difference between profit and loss in a cutting, these men have been wary of purchasing Virginia pine sawtimber.

Logging operations on the Beltsville Experimental Forest presented an opportunity to investigate certain aspects of this rot. It was observed that rot was rarely found in the younger stands on the forest—those under 50 years of age. However, cuttings made in the older sawtimber stands revealed that this rot might be an important factor in limiting lumber merchantability.

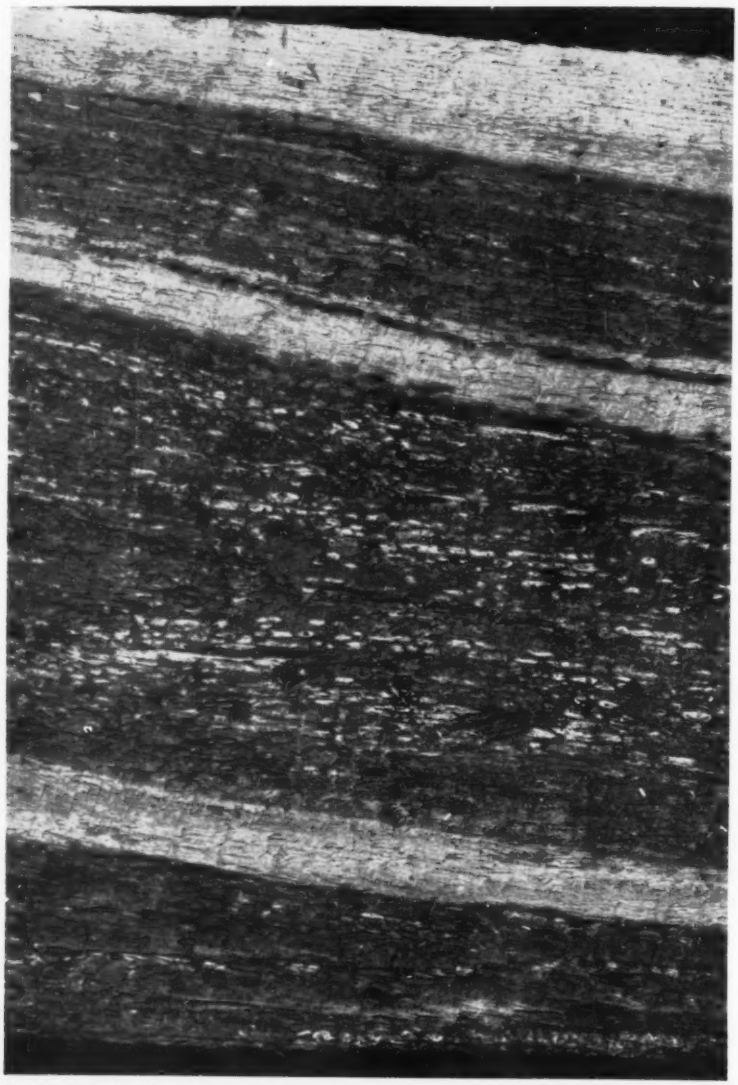

FIG. 1.—Typical appearance of advanced red ring rot in Virginia pine lumber. The white flecks are characteristic of advanced rot; they do not appear in the incipient stage.

Because these observations seemed to support the opinion of local sawlog cutters, a study was made of trees, logs, and lumber cut from sawtimber stands on the Experimental Forest. Further study, conducted in other areas, would possibly modify to some extent the findings reported here, particularly the volume-loss data. However, the information gained in the present study has general application, it is believed, in much of the Virginia pine territory.

The principal study objective was to determine the actual lumber losses from this rot in mature Virginia pine stands. Attention was also given to the following: the extent of rot with respect to location in the tree; the relation of tree age to occurrence of rot; and means of recognizing infection before and after cutting. In addition, it was hoped that the study findings could be of value by providing information for more accurate deductions in scaling sawlogs.

The stands from which the sample logs were obtained were situated on a rather shallow sandy loam underlain by semi-impervious clay. The land was nearly flat, with fair drainage. Seventy percent of the stand volume was pine, about equally divided between pitch pine

[1]Respectively, research forester, Northeastern Forest Experiment Station, U.S. Forest Service, and associate pathologist, Crops Research Division, Agricultural Research Service, U.S. Department of Agriculture.

and Virginia pine. The remainder was practically all oak. There was evidence that at least one fire had occurred in the stands, probably within the past 10 years.

Study Methods

The trees used in the study were from randomly picked areas in clearcutting operations. All Virginia pines 10 inches d.b.h. or larger within these areas were included. Before cutting, each sample tree was numbered and d.b.h. and crown class were recorded. Note was made of any unusual condition seen, particularly fungus fruiting bodies on the trunk, fire scars, wounds, excessive limbiness, and pitch flows around branch stubs on the trunk.

The trees were felled and bucked and data were taken as follows: diameter and age of tree at stump height; length, scaling diameter, and scale volume of logs; arrangement of dead or overgrown branch stubs along the trunk; length of live crown; and a description of any rot visible on the stump or ends of logs. If fungus fruiting bodies were present, descriptions of them were recorded and their locations were measured from stump height.

Minimum log diameter was 8 inches at the small end. Log lengths ranged from 10 to 16 feet; evidence of rot was not a factor in determining log length in the study. Average length of the butt logs was 13 feet, of second logs 14 feet, and of the third logs 12 feet. In scaling, the International ¼-inch rule was used. Deductions for defects other than rot were made following standard rules as given in the National Forest Scaling Handbook. For rot, however, deductions were based on the scaler's best estimate of expected loss and were recorded separately.

During logging, random samples were taken of typical infected wood. These were cultured; the causal fungus of the rot proved to be *Fomes pini* (Thone) Lloyd, as suspected. Occasional pockets of *Polyporous schweinitzii* (Fr.) were isolated, but loss from this fungus proved negligible.

In all, 168 Virginia pine trees provided 382 sample logs. These were trucked to a local mill and sawed.

As the logs were sawed, all lumber produced was classified into three categories: (1) *sound*—lumber that did not show any red ring rot; (2) *red rot merchantable*—lumber that showed only firm red ring rot; and (3) *non-merchantable*[2]—lumber that went into the slab pile because of advanced decay (Fig. 1).

Table 1.—Lumber Yield From 382 Virginia Pine Sawlogs, by Merchantability Classes

Merchantability class	Lumber tally	Proportion of total volume
	Board feet	*Percent*
Sound	15,604	83.2
Red rot merchantable	2,822	15.0
Non-merchantable	338	1.8
Gross yield	18,764	100.0

Table 2.—Lumber Loss From All Trees Infected With Advanced Red Rot

Tree[1] groups	Trees	Gross lumber yield	Non-merchantable lumber	
	Number	*Board feet*	*Board feet*	*Percent*
A	6	576	184	32
B	9	1,031	154	15
Total	15	1,607	338	21

[1]Tree Group A: trees with fruiting bodies. Tree Group B: all other trees with advanced decay.

Results

In the 382 sample logs sawed, loss due to red ring rot was less than 2 percent of the lumber produced. This was considerably less than anticipated (Table 1).

However, 15 percent was affected with incipient decay—firm red ring rot. This stage causes little or no

[2]A few mills utilize such "non-merchantable" lumber as dunnage. The only limitation is that boards hold together in handling.

Fig. 2.—A well-developed fruiting body of *Fomes pini* 2 feet above base of 75-year-old Virginia pine.

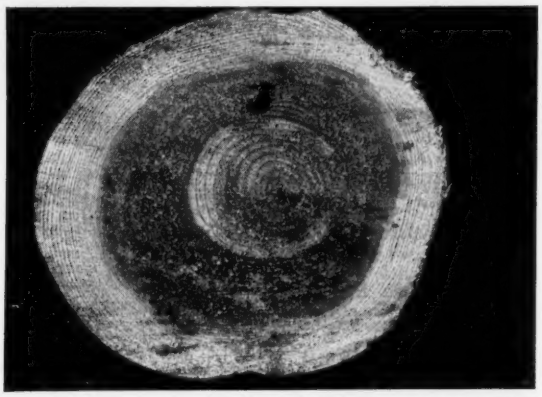

Fig. 3.—Cross-section of Virginia pine butt log showing typical discoloration of heartwood caused by *Fomes pini*.

TABLE 3.—RED ROT CULL LUMBER IN BUTT AND UPPER LOGS OF VIRGINIA PINE

Tree[1] group	Trees	Cull-lumber in butt logs	Cull lumber in 2nd logs	Cull lumber in 3rd logs
	Number	*Percent*	*Percent*	*Percent*
A	6	54	0	0
B	9	32	14	0

[1]Tree Group A: trees with fruiting bodies. Tree Group B: all other trees with advanced decay.

reduction in strength,[3] but it may reduce the sale value of such lumber.

Incipient rot is characterized by a distinct reddish coloration in freshly sawed heartwood, but does not show the white flecks indicative of advanced decay. It may range from almost imperceptible streaks to involvement of the entire piece. Approximately 35 percent of the surface area of the affected lumber was discolored.

Overall loss small.—Although the total volume of non-merchantable lumber in the sample was not large, losses in certain trees were serious (Table 2). These losses are based on all trees in the study found to contain advanced rot after sawing at the mill. Six of these trees bore fungus fruiting bodies of *Fomes pini* (Fig. 2); while in the remainder, decay was readily seen after the logs were bucked (Fig. 3).

Trees bearing fruiting bodies yielded over twice as much non-merchantable lumber as trees in which no evidence of rot was noted until they were felled or bucked into logs (Table 2). Of the remaining 153 trees, incipient decay was found in the logs of 37 of them. The rest were entirely sound.

[3]Forest Products Laboratory. Wood handbook. U.S. Dept. Agric. Handbook 72. 528 pp., illus. 1955.

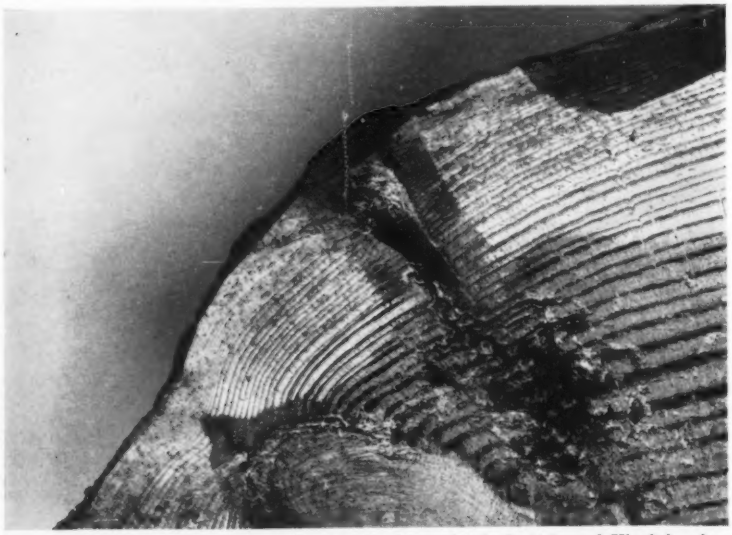

FIG. 4.—Advanced decay under rotten knot entry point in butt log of Virginia pine.

Butt logs most seriously affected.—Practically all lumber unmerchantable because of red ring rot was produced from the butt logs (Table 3). Observations made during sawing indicated that the high incidence of red ring rot in the butt logs may have been due to dead but long-persisting branch stubs that became entry points for the fungus in the lower part of the bole (Fig. 4).

Relation of age to infection.—Slocum and Miller[4] reported that heart rot was found extensively in older stands of Virginia pine in North Carolina. In stands 56 and 59 years old, 23 and 34 percent respectively of the trees were found to be infected.

In the present study, similar amounts of red ring rot, both incipient and advanced, did not develop until the stands were about 10 years older. Trees ranging from 50 to 59 years old showed negligible infection, with no advanced decay. In the 60-69-year age class, 25 percent of the trees showed infection, and 7 percent contained advanced decay. Above age 70, decay assumed increasing importance (Table 4).

These data seem to indicate that sawlog rotations up to 70 years should be feasible in the more northerly portions of the Virginia pine range.

To explore further the apparent evidence that red ring rot was unimportant up to age 50 as reported by Slocum and Miller, a random examination was made of pulpwood cut from a 45-year old Virginia pine stand adjacent to the

[4]Slocum, G. K., and Miller, W. D., Virginia Pine. N. C. Expt. Sta. Tech. Bul. 100. 52 pp., illus. 1953.

TABLE 4.—OCCURRENCE OF RED ROT IN FOUR AGE CLASSES OF VIRGINIA PINE

Age class	Trees in class	Total volume of lumber	Occurrence and stage of red rot in lumber and trees								
			Advanced decay			Incipient decay			No decay		
			Lumber		Trees	Lumber		Trees	Lumber		Trees
Years	*No.*	*Board feet*	*Board feet*	*Percent*	*Percent*	*Board feet*	*Percent*	*Percent*	*Board feet*	*Percent*	*Percent*
50-59	31	2,870	0	0.0	0.0	42	1.4	3.0	2,828	98.6	97.0
60-69	40	3,954	51	1.3	7.0	482	12.2	18.0	3,421	86.5	75.0
70-79	78	9,561	131	1.4	10.0	1,617	16.9	28.0	7,813	81.7	62.0
80-90	19	2,379	156	6.6	21.0	681	28.6	37.0	1,542	64.8	42.0

study area. Over 600 bolts, many of them butt cuts, were inspected. Only one instance of red ring rot was found, and it was but a trace.

Detection of rot in standing trees.—Each sample tree was critically examined before cutting, as described previously. Of the various possible red ring rot indications seen, the only one positively associated with advanced decay was the presence of fruiting bodies on the trunk.

Fruiting bodies were not only reliable indicators of decay; their position on the tree, while not delineating the extent, also denoted the general location of advanced decay. No sporophores were found more than 6 feet above ground and, as shown in Table 3, all lumber loss from trees bearing fruiting bodies occurred in the butt log on which they were located.

Fruiting bodies occasionally develop higher on the trunk, thus indicating advanced decay in that portion. For example, the tree used for Figure 2, not a study tree, bore fruiting bodies at 2, 5, 7, and 11 feet; it contained extensive advanced rot with traces of incipient decay up to 41 feet. As a rule, however, rot indicators and the accompanying decay are confined to the lower portion of the trunk.

Although fruiting bodies are the outward evidence of advanced decay, their location does not accurately denote its extent within the tree. In one case, a well-developed sporophore at 6 feet marked the upper limit of decay; but on another tree, with a single sporophore at 4 feet, advanced decay had progressed at least 12 feet up the trunk.

Discussion

Effect on lumber yield and quality.—Of a gross volume of 18,764 board feet of lumber sawed from Virginia pine harvested in central Maryland, 338 board feet—less than 2 percent—was found nonmerchantable because of advanced red ring rot. Eighty-five percent of this loss occurred in trees 70 to 90 years old. This indicates that in sawlog-size Virginia pine stands, red ring rot may not be a serious factor up to age 70.

A considerably larger volume of the lumber, 15 percent, contained incipient decay. This stage may not devalue pine lumber used for finish purposes. Nor does it weaken structural lumber, even if the incipient decay is extensive. However, buyers tend to be prejudiced against lumber that has the reddish staining, even though its quality is not impaired and the rot will not spread further.

Red ring rot indicators.—As already noted, the only evidence found to reliably indicate advanced red ring rot in standing trees was the presence of fruiting bodies on the trunk. All such trees in the study yielded considerable cull lumber.

Although not considered in this study, it is probable that the extent of advanced decay is related to the age of fruiting bodies. While living, and while the fungus organism continues to progress in the heartwood, they undergo a period of annual growth. This is indicated by shell-like concentric rings, reddish-brown for the current year and dull gray for each previous year's growth.

Other possible indicators of red ring rot in standing trees were not found reliable. The occurrence of heavy pitch flows from old branch stubs was a particular cause for suspicion; but even though this condition was very obvious on many trees, no correlation with the existence or extent of red ring rot was found. A few trees with extensive pitch flows contained red rot; others similarly affected were sound.

Some trees without fruiting bodies contained incipient or advanced decay, but this could not be detected until they were felled. If decay was present it was most commonly observed in the stump and butt log. The condition and extent of such rot on the ends of logs was a clue to probable lumber loss.

Observations during logging showed that infected trees often occurred in groups. In one cutting area, all five Virginia pine trees within 20 feet of a rotten pine snag were affected to some extent with advanced rot; trees farther away showed only incipient decay or none at all. Very likely, this group of trees became infected from the pine snag prior to its death, possibly by natural root grafts, since this has been known to occur.[5]

Effect on scaling practices.—A sound basis for accurately deducting for this defect in scaling will require further investigation. For example, in scaling the sample logs, the deductions made for red ring rot totaled 1,400 board feet—considerably more than the actual loss. Much of this discrepancy was due to the difficulty of predicting the occurrence, extent, and stage of decay within the logs before sawing. From experience gained in this study, however, a few suggestions are possible.

A. Fruiting bodies of *Fomes pini* present.

All trees and logs in the study that bore fruiting bodies contained advanced decay. In similar cases, therefore, moderate to complete loss of merchantability can be expected.

If a fruiting body of *Fomes pini* is noted on a pine log of any length, and red ring rot is visible at both ends, the log should be culled. If infection shows at one end only—even if but a trace—the gross volume of such a log should be halved. In the study, this was the minimum accepted limit of merchantability.

Should a tree bear more than one fruiting body, so spaced that they cannot be contained on one log, it is more than likely a waste of time and money to cut it.

B. Fruiting bodies of *Fomes pini* absent.

Trees with no fruiting bodies may still contain advanced red rot. This, however, cannot ordinarily be determined prior to felling. If infection is present, it will usually be seen on the stump when the tree is dropped.

If incipient decay is seen on the stump, but the top of the butt log

[5]Boyce, J. S. Forest pathology. 2nd Ed., 550 pp., illus. McGraw-Hill Book Co., New York. 1948.

is sound, there should be no loss. Incipient decay at both ends of the butt log is seldom seen where fruiting bodies are absent.

If the butt log shows advanced decay at either or both ends, some scale deduction should be applied. If present at one end only, a 50-percent deduction should be made; but if seen at both ends the log should be culled.

In the upper logs, red ring rot is ordinarily of minor importance. As a rule, they are sound if the butt log is sound. However, should the upper logs exhibit the same decay pattern as discussed for butt logs, similar deductions for rot should be applied to these logs.

These scaling suggestions are provided only as a general guide in making appropriate deductions for red rot when using the International ¼-inch rule. They are not precise measurements but should be considerably better than guesses.

It is recommended that all scaling be done soon after felling and bucking. Once the ends of logs have become weathered and checked, advanced decay is difficult to evaluate or even recognize, and incipient decay becomes entirely invisible.

Results of Some Silvicultural Tests in Pole Blight Diseased White Pine Stands

Donald P. Graham[1]
Intermountain Forest and Range Experiment Station, Forest Service, U. S. Department of Agriculture

POLE BLIGHT, a serious disease of western white pine (*Pinus monticola* Dougl.), has been observed in western Montana, northern Idaho, and eastern Washington for approximately 25 years (*2*). This disease is causing large losses in pole-sized stands on about 95,000 acres (*1*). Several salvage operations to remove pole-blighted trees from affected stands have been conducted and numerous others are proposed. Information is needed on the effects of salvage operations and other forest management practices on the intensification and spread of the disease and on growth and mortality.

This report presents the results to date of two separate but related studies of the effects of cutting on pole blight. The first study consists of two groups of thinning plots that were established in 1933 and 1934 within thinned tracts several acres in size. Pole blight did not appear in the plots until about 10 years after establishment. The second study is concerned with the effects of cutting on pole blight on a series of plots established in 1950.

[1]Plant pathologist, Division of Forest Disease Research, Inland Empire Research Center, Intermountain Forest and Range Experiment Station, Forest Service, U. S. Department of Agriculture, Spokane, Washington.

TABLE 1.—WHITE PINE BASAL AREA[1] PER ACRE AND PROPORTION OF BASAL AREA BY TREE CONDITION ON THINNED AND UNTHINNED PLOTS IN SANDS CREEK AND FOURTH OF JULY CANYON STANDS, AT TIME OF LAST PLOT EXAMINATION[2]

Tree condition	Sands Creek plots				Fourth of July Canyon plots			
	Thinned		Unthinned		Thinned		Unthinned	
	Sq. ft.	*Percent*	*Sq. ft.*	*Percent*	*Sq. ft.*	*Percent*	*Sq. ft.*	*Percent*
Pole blight diseased:								
Living	33	24	15	7	45	36	23	21
Dead	25	18	11	6	25	20	4	4
Total	58	42	26	13	70	56	27	25
Healthy	81	58	172	87	55	44	82	75
All trees	139	100	198	100	125	100	109	100

[1]Includes all western white pine trees 0.6 inch d.b.h. and larger.
[2]The Sands Creek plots were last examined at end of 1953 growing season and the Fourth of July Canyon plots at end of 1954 growing season.

Effect of Pole Blight in Thinned and Unthinned Stands

More than 20 years ago, before pole blight was recognized as a serious disease, several thinning plots were established in pole stands of the white pine type. Two groups of these thinning plots, located in the Sands Creek and the Fourth of July Canyon drainages on the Coeur d'Alene National Forest, became affected with pole blight in the mid-1940's. Since the onset of pole blight the white pine at these two locations has suffered severe damage. To evaluate the effect of pole blight in the thinned and unthinned stands, growth and mortality have been compared for the periods before and after the appearance of pole blight.

In the Sands Creek drainage, five ¼-acre plots were established in 1933 in a 16-acre area thinned the same year when the stand was 65 years of age. Three ¼-acre unthinned check plots were established at the same time as subplots of nearby yield plots that had existed since 1923. Thinning was largely from below to favor white pine. The less desirable species were removed along with trees having poor crowns, vigor, and form.

After thinning, the white pine stand on the five plots averaged about 300 of the best trees per acre with 106 square feet of basal area.

Four ¼-acre plots were established in the Fourth of July Canyon stand in 1934; the stand was then 33 years old. Two of these plots were established in a 13-acre area thinned the previous year, and two in an adjacent unthinned area. Before thinning, the stand was dominated by western larch, but white pine made up the major portion of the stand. A combination of thinning from above and below was used to release white pine. After thinning, the white pine stand on the two thinned plots averaged about 480 trees per acre with 55 square feet of basal area.

Pole blight was first discovered in the Sands Creek drainage in 1932 but was not observed in the plots until after 1943. In the Fourth of July Canyon plots, the disease was not present in 1939 but was well established when the plots were re-examined in 1949.

Pole blight damage in thinned and unthinned stands. — Table 1 summarizes pole blight damage on the thinned and unthinned plots at both locations at the time of the last examination (1953 and 1954). In the Sands Creek thinned plots, 42 percent of the white pine basal area was affected; in the Fourth of July Canyon thinned plots, 56 percent. Basal area damage for the two locations averaged 49 percent. Comparatively, the unthinned plots had a damage of 13 and 25 percent, respectively, or an average of 19 percent for the two locations. Therefore, in the thinned plots pole blight damage was 2.6 times that in the unthinned plots. This difference is statistically significant at the 5 percent level. In a comparison of damage between locations, the percentage of white pine basal area affected in the Fourth of July Canyon plots was 1.3 times that in the Sands Creek plots, but this difference is not statistically significant.

Effect of pole blight on diameter growth.—Average annual diameter growth of healthy dominant and codominant white pine trees that remained healthy since plot establishment was compared with diameter growth of those that became diseased or died from pole blight. This comparison was made even for the years prior to the onset of pole blight by tracing back the diameter growth of individual trees that later became diseased. Diameter growth was compared by 5-year growth periods except for the 10-year period, 1939-1949, on the Fourth of July Canyon plots. The effect of pole blight on average annual diameter growth is illustrated in Figure 1.

Prior to the onset of pole blight in the Sands Creek plots, variation in average annual diameter growth between tree condition classes was not great for any one growth period. For the two 5-year periods subsequent to the onset of pole blight, average annual diameter growth of healthy trees in the thinned plots was 1.1 and 1.5 times that of pole-blighted trees. In the unthinned plots those trees remaining healthy also had a greater diameter growth than those that became blighted. Most trees that died showed a rapid decline in diameter growth for the 5-year period prior to death.

On both the thinned and unthinned Fourth of July Canyon plots prior to the onset of pole blight, those trees that later became affected grew somewhat faster in diameter than those that remained healthy. During the period following the invasion by pole blight, diameter growth of diseased trees on the thinned plots was markedly less than that of the healthy trees. However, on the unthinned plots diameter growth of diseased trees continued to be greater than that of the healthy trees. As in the Sands Creek plots, most of the trees that died showed a decline in diameter growth during the 5-year period prior to death.

Effect of pole blight on cubic-foot volume growth.—The effect of pole blight on net cubic-foot volume growth of white pine is illustrated in Figure 2. Cubic-foot volume mortality from pole blight and other causes is also shown.

Both groups of plots showed a large decrease in volume growth and an increase in total mortality coinciding with or following the appearance of pole blight. In the Sands Creek thinned plots, net growth was good during the 10 years before the onset of pole blight. After pole blight became prevalent, net annual growth declined sharply to 35 cubic feet per acre for the first five years and to only 3 cubic feet the second five years. Mortality increased accordingly, and pole blight accounted for most of the losses. Net growth was also good in the Sands Creek unthinned plots before the appearance of pole blight except for the 1933 to 1938 period. In the unthinned plots, only a small decline in cubic-foot volume occurred during the first five years after the onset of plot blight, but a very sharp decline occurred during the second five years and resulted in a net annual loss of 77 cubic feet per acre. Volume growth on the thinned and unthinned Fourth of July Canyon plots did not decline until the last 5-year period, when the thinned plots suffered a net loss of 15 cubic feet per acre per year, and the unthinned plots gained only 5 cubic feet per acre annually. Comparable figures for the growth period before pole blight was well established (1939-1949) were 143 cubic feet and 94 cubic feet, respectively.

Effects of Salvage Cutting on Spread and Intensification of Pole Blight

A series of plots to determine the effects of salvage cutting on the spread and intensification of pole blight was established in 1950 in the Bear Paw Creek drainage, Kaniksu National Forest. The primary purpose was to compare the progress of pole blight in stands in which the diseased pines were removed with the course of the disease in uncut stands.

To accomplish this objective, an

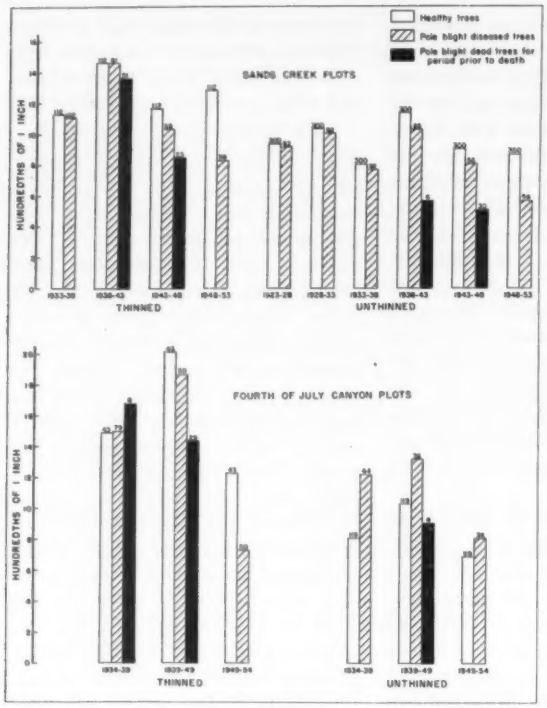

FIG. 1.—Comparison of average annual diameter growth of dominant healthy and diseased trees by growth periods on Sands Creek and Fourth of July Canyon thinning plots. (Numerals above bars indicate numbers of trees measured.)

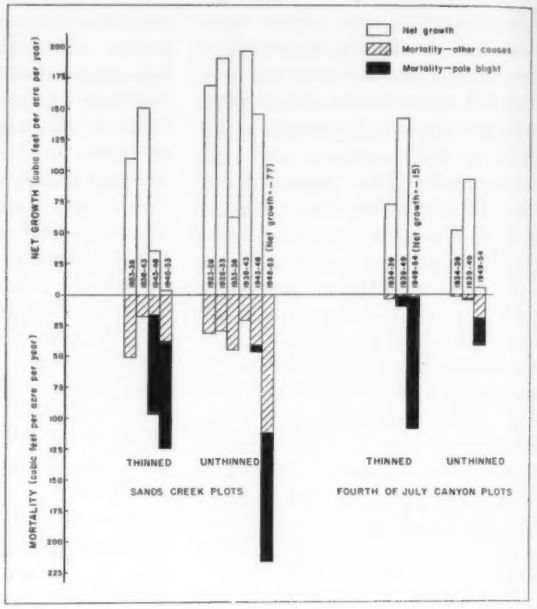

FIG. 2.—Comparison of volume growth and mortality of total white pine stand prior to and subsequent to the onset of pole blight.

85-acre tract was selected, and nine plots of approximately 9.5 acres each were established in a Latin square design. The following three treatments were randomly applied to the nine plots:

1. Check—no cutting.
2. Remove merchantable pole blight trees by cutting (partial removal).
3. Remove all pole blight trees by cutting merchantable trees and poisoning nonmerchantable trees (complete removal).

Five 1/5-acre sample plots were established within each 9-acre plot. All white pine trees on these forty-five 1/5-acre plots were measured and examined for pole blight in 1950 before cutting, in 1952 after completion of cutting, in 1955 three years after cutting, and in 1957 five years after cutting.

The change in basal area affected by pole blight in the cut plots compared with that in the uncut plots was considered to be the best indication of spread and intensification of the disease. This change is shown in Table 2. The data were based on the basal area diseased or dead on the 1/5-acre sample plots at the time of examination expressed as a percentage of the 1950 white pine basal area. The 1950 basal area was used so that growth would not compensate for the increases in pole blight.

In 1950, before cutting, basal area damage was 30.0 percent on the partial removal plots and 44.4 percent on the complete removal plots. Damage on the uncut check plots was 33.5 percent and averaged 36.0 percent for all plots combined. Following the completion of poisoning and cutting, only 0.7 percent of the original pole-blighted basal area was left on the partial removal plots and 0.3 percent on the complete removal plots. Therefore, from a practical standpoint, the partial removal plots and the complete removal plots were about equally free of pole blight. During the prolonged pe-

TABLE 2.—PROPORTION OF 1950 TOTAL WHITE PINE BASAL AREA DISEASED OR DEAD BY POLE BLIGHT ON BEAR PAW CREEK CUTTING PLOTS IN 1952, 1955, AND 1957

Treatment	Pole blight damage				
	1950	1952[1]	1955[1]	1957[1]	
	Before cutting	After cutting	Three years after cutting	Five years after cutting	Increase 1952-57
	Percent				
No removal	33.5	35.2	38.0	39.3	4.1
Partial removal	30.0	.7	4.0	5.5	4.8
Complete removal	44.4	.3	4.1	7.2	6.9
Average, all treatments	36.0	12.1	15.4	17.3	5.3

[1]Excluding growth that occurred after 1950.

riod of cutting, pole blight damage on the check plots increased from 33.5 to 35.2 percent.

For the 5-year period following cutting, the increase in basal area of pole blight damage was 4.1 percent on the check plots, 4.8 percent on the partial removal plots, and 6.9 percent on the complete removal plots. These differences in damage are not statistically significant.

Summary

This report presents data from two studies on the effects of cutting on pole blight of western white pine: (1) results of two groups of thinning plots at two locations and (2) the effect of salvage cutting on spread and intensification of the disease. The results are suggestive rather than conclusive, and additional observations will be necessary to substantiate trends that have appeared.

Basal area damage from pole blight in the thinned plots was 2.6 times that in the unthinned plots. This difference is statistically significant and suggests that thinning will hasten stand deterioration if pole blight occurs subsequent to treatment.

Pole blight caused a decline in diameter growth of affected trees in both thinned and unthinned plots. Growth of these affected trees before they became blighted was equal to or greater than that of comparable trees that remained healthy. This decline was more pronounced on the thinned than on the unthinned plots. A sharp reduction in net cubic-foot volume growth and an increase in mortality occurred with the appearance and subsequent intensification of pole blight. After the disease became well established, mortality was sufficiently high to cause a loss or only a negligible gain in net volume growth of white pine.

In the Bear Paw Creek salvage cutting plots, pole blight continued to increase in the residual stand irrespective of the treatment received. The removal of blighted trees did not delay or prevent the subsequent invasion by pole blight in the residual healthy trees. An analysis of variance revealed no significant difference in pole blight intensification between the three treatments. The data suggest, however, a slight increase in basal area damage in the cut plots compared to the uncut plots.

Early results from these studies indicate that thinning subsequent to the appearance of the disease and salvage cutting of affected areas do not reduce disease progress in the residual stand.

Literature Cited

1. Graham, Donald P. 1955. Distribution of pole blight of western white pine. Intermountain Forest and Range Expt. Sta., Research Note 15, 3 pp. (Processed.)
2. Pole Blight Investigations Steering Committee. 1952. Pole blight, what is known about it. Northern Rocky Mt. Forest and Range Expt. Sta., Misc. Pub. 4, 17 pp.

SECTION BOX SCORE 1958 MEMBERSHIP

	Applications Received[1]		
	April 1958	Total 1957	Total 1958
Allegheny	5	68	34
Appalachian	1	71	11
Central Rocky Mountain	2	24	7
Central States	0	30	17
Columbia River	11	55	29
Gulf States	2	84	15
Inland Empire	1	21	11
Intermountain	2	6	30
Kentucky-Tennessee	1	8	3
New England	4	62	28
New York	0	37	15
Northern California	0	39	8
Northern Rocky Mountain	9	49	13
Ozark	0	92	14
Puget Sound	6	61	29
Southeastern	9	132	79
Southern California	0	3	0
Southwestern	0	7	0
Upper-Mississippi Valley	9	69	36
Washington	0	10	1
Wisconsin-Michigan	8	84	37
Totals	70	1,012	417

[1]Student, Junior, Affiliate, Associate (Initial) grades only.

SCHOOL BOX SCORE 1958 MEMBERSHIP

	Student Applications Received		
	April 1958	Total 1957	Total 1958
Alabama Polytechnic Institute	0	19	22
University of California	0	30	55
Colorado State University	2	19	7
Duke University	0	13	2
University of Florida	1	6	14
University of Georgia	7	86	36
University of Idaho	0	19	10
Iowa State College	2	35	11
Louisiana Polytechnic Institute	0	18	4
Louisiana State University	0	41	1
University of Maine	0	31	18
University of Massachusetts	2	10	2
Michigan Coll. of Mining & Tech.	0	29	3
Michigan State University	5	24	13
University of Michigan	0	14	10
University of Minnesota	7	28	23
University of Missouri	0	62	7
Montana State University	8	45	9
State University of New York	0	25	12
North Carolina State College	0	36	1
Oregon State College	9	29	20
Pennsylvania State University	1	32	16
Purdue University	0	18	17
Utah State University	0	5	24
University of Washington	4	27	19
West Virginia University	2	19	15
Yale University	0	7	3
Totals	50	727	374

Notes

Humigraph Card for Determining Relative Humidity Factor in Prescribed Burning

Prescribed burning research work in Texas has brought out the importance of relative humidity to fire behavior and burning index or rate of spread. It is a major factor along with wind velocity and stability, fuel moisture per cent, and moisture condition of lower fuel layer that must be considered for safe and permissable burning in specific fuel types. Practical burning guides featuring these factors have been developed and released[1] for prescribed burning in pine-hardwood stands and slash pine plantations on lower Coastal Plain, flatwood sites.

During the course of research work relative humidity determinations were made with a sling psychrometer illustrated in Figure 1. This instrument is accurate and is used as standard equipment at U. S. Weather Bureau stations and for fire control purposes by many state forestry agencies. Considerable tedium and care is required to operate the sling psychrometer, however.

As research proceeded it was anticipated that prescribed burning for undesirable hardwood control could be more readily promoted on private lands if simple but accurate guides and equipment could be used by the average landowner.

In 1953 Clive Countryman[2] described a humidity indicator card used in California on fire prevention and control work. The card permitted direct ocular humidity estimates within ranges of 7 to 50 percent. Since humidity levels along the southern Coastal Plain exceed this range another source of card indicator was sought.

Similar humigraph cards cover-

[1]Silker, T. H. Prescribed burning for the control of undesirable hardwoods in pine-hardwood stands and slash pine plantations. Bul. 46. Tex. For. Service, 19 pp. 1955.

[2]Countryman, Clive M. A pocket type humidity indicator for use in fire prevention and control. Misc. Paper No. 12, USDA Calif. For. & Range Expt. Sta., 1 pp. 1953.

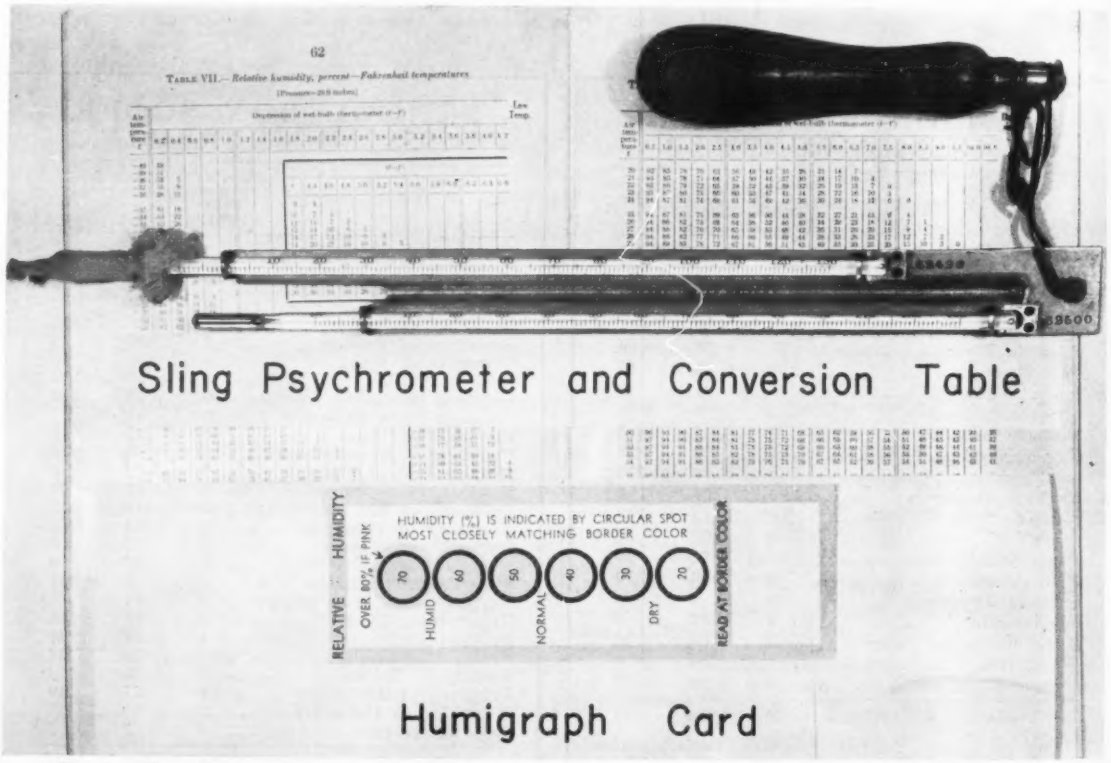

FIG. 1.—*Above*, sling psychrometer and conversion table normally used for determining relative humidity. *Below*, new humigraph card tested for field determination of relative humidity.

ing humidity ranges from 20 to 70 percent were procured[3] and put under observed use. The card, as illustrated in Figure 1, is 2 inches by 5¾ inches in size. It is normally used to check humidity levels in warehouses. The six circular areas are treated with chemical solutions of different concentration. The areas change color from pink to blue as humidity decreases and back to pink as humidity increases. Around the card border is a standard reference color of light blue. Relative humidity percent is indicated by the circular spot most closely matching the border color. With practice it is possible to interpolate for readings between two adjacent spots. Thus, intermediate humidity levels can consistently be estimated so that readings usually do not vary more than 2 to 5 percent from sling psychrometer readings.

Minimum requirements for use of the humigraph card require the observer to (1) perceive color differences and shades between the blue and pink colors, (2) minimize handling to avoid excess dirt and grease, and (3) provide minimum exposure of about 5 minutes, in shade, or until color change has become stable.

Data for three observers using humigraph cards and sling psychrometers at widely scattered locations in East Texas are presented in Table 1. These observers had no previous experience with humigraph cards but were shown how to interpolate intermediate readings and were instructed to determine and record card readings before sling psychrometer readings were made. Readings represent data obtained during the first month of use. It is obvious all observers were able to interpolate intermediate readings quite accurately and humidity did not vary much from the psychrometer readings assumed as accurate and standard.

Table 1.—Variation in Relative Humidity, 1 p.m. Readings, of Three Observers Using Sling Psychrometer and Humigraph Card at Three Texas Locations

Observer location	Percent variation[1] and number observations								
	0	±1	± 2	±3	±4	±5	±6	±9	Total
Linden	3	2	5	1	1	3	1	--	16
Maydelle	3	2	6	5	3	--	1	--	20
Kirbyville		5	5	3	3	1	2	1	20
Total	6	9	16	9	7	4	4	1	56

[1]Card readings compared to psychrometer as standard.

A further test on humigraph card variation was made for a two-month mid-summer period to cover the season when low humidity frequency might be higher. Two readings were taken daily, at 11 a.m. and 1 p.m. A probability test for card variation from sling psychrometer readings showed highly significant t values of 2.898 and 4.474 for 11 a.m. and 1 p.m. readings, respectively, while table values for t at the 1 percent level are 2.693 and 2.682 for 11 a.m. and 1 p.m. readings, respectively. Thus, chance individual variations from the data mean are considerably less than 1 in 100. It was noted the greatest possibility for variation apparently results from insufficient card exposure when humidity levels are low. On cloudless days cards should be given an exposure longer than 5 minutes to permit complete color change before readings are attempted.

Experience with the humigraph cards indicates that they may supplant the sling psychrometer for most field determinations of relative humidity. They can be carried without any encumbrance to an observer and are therefore available at all locations. Their cost is 25 cents or less, each, so purchase and replacement investments are nominal. They can be readily used by the average layman since readings can be obtained quickly and directly without cross-reference to tables. They are less subject to damage than the psychrometer. They can be carried in a plastic envelope and need only be protected against complete saturation and excess grease and dirt. When so protected they have been used 6 months and longer.

Since the humigraph cards require only a nominal cost any private landowner can justify card purchase and use in planning and making prescribed burns. Their availability and other advantages have increased their popularity and use in recent prescribed burning on private land.

Biologists of the Texas Game and Fish Commission have recently adopted the cards for field determination of humidity for correlation with wildlife movements and census procedures. It is anticipated that forest fire control forces will credit humidity as a greater factor affecting burning index or rate of spread. Humigraph cards can then be used by dispatchers and field crews for deploying forces for given field conditions and fuel types. The cards may also be useful in plotting and controlling humidity in greenhouses for forest genetics studies and other related work where a high degree of accuracy is not essential.

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[3]Daigger Apparatus Digest, A. Daigger & Co., Chicago, Ill.

Remarkable Shortleaf Pine Stand

One of the best stands of shortleaf pine (*Pinus echinata* Mill.) in America today is in the northwest corner of White County in north Arkansas, about 10 miles south of Heber Springs. The 8.3-acre tract belongs to Lt. Col. J. S. Gifford, U. S. Army (retired), who owns and operates it as part of a tree farm.

The stand seeded in on an old field around 90 years ago. It now contains 281,948 board feet gross volume (Int. ¼-inch rule). The average acre contains 33,970 board feet. The heaviest single acre supports 40,200 board feet of gross volume and has a basal area of 150.72 square feet. The most heavily stocked 0.1-acre contains 6,483 board feet and has a basal area of 24.95 square feet. These figures are based on measurements of all trees.

During the past decade Col. Gifford has salvaged approximately 4,300 gross board feet per acre from mortality, so that mean growth rate (including salvaged mortality) has been 425 board feet per acre annually for 90 years. He has done no other cutting or trimming. Excessive stocking has probably reduced diameter growth and has undoubtedly contributed to the heavy mortality. Windthrow has been considerable. A single ice storm in January 1957 caused a loss of 11,288 board feet.

The average tree is about 13 inches d.b.h., but a few have reached 22 inches. Half the volume is in trees 16 inches and larger. Average merchantable height for sawtimber is four 16-foot logs; the range is from 42 feet in 8-inch trees to 75 feet in 22-inch trees. Girard form class varies from 84 percent for 2-log trees to 90 percent for several 5-log trees. Total height ranges from 74 feet for 8-inch trees to 99 feet for 22-inch trees.

The stand occupies what would normally be regarded as a medium to poor site. Site index is about 70 as read from the U. S. Forest Service's Miscellaneous Publication 50[1] and about 65 by Coile's soil-site indices formula.[2]

The A-horizon has a depth of about 10 inches of sandy loam; the B horizon, about 24 inches of semiplastic clay loam and sandy clay loam. Preliminary mapping by the Soil Survey Division of the U. S. Soil Conservation Service classified the soils as Cleburne fine sandy loam, Linker fine sandy loam, and Linker gravelly fine sandy loam.

Several nearby stands owned by the Long-Bell Division of the International Paper Company are 30 years younger than the Gifford Tract and show promise of equalling its yield. Additional noteworthy examples of shortleaf growth occur on similar soils within the Ozark National Forest some distance from the Gifford and Long-Bell areas. The fact that excellent shortleaf pine growth in each instance is associated with a history of fire protection and moderate cutting indicates that a similar potential exists on a surrounding area of possibly one million acres underlain by similar

FIG. 1.—This stand of shortleaf pine, on a medium site in North Arkansas, averages 34,000 board feet per acre, lumber tally, having grown a mean volume of 425 board feet per acre per year for 90 years. Its performance offers hope for a rehabilitation program on extensive surrounding areas of similar sites.

[1]U. S. Forest Service. Volume, yield, and stand tables for second-growth southern pines. U. S. Dept. Agric. Misc. Pub. 50, 202 pp. 1929.

[2]Coile, T. S. Relation of soil characteristics to site index of loblolly and shortleaf pines in the lower Piedmont region of North Carolina. Duke Univ. School Forestry Bul. 13, 78 pp. 1948.

soil profiles—provided, of course, that present stands are rehabilitated.

The Gifford Tract gives heart to the forester who is sometimes discouraged by the fact that individual shortleaf pines tend to grow more slowly than loblolly pines. Shortleaf stands compensate by supporting more stems to the acre than loblolly does, and yields are often comparable.

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The Ditch Bank Tool—An Implement for Cleanings[1]

As intensity of management increases, greater acreages of young stands are being cleaned. Cleaning, a selective job, may be accomplished by either chemical or mechanical methods. While it is impossible to estimate to what extent cleaning will be done in the future by chemical means, for the present, at least, much of it is done mechanically. It is for this latter method that the writers would like to call attention to an implement little known to foresters outside the South—the ditch bank tool.

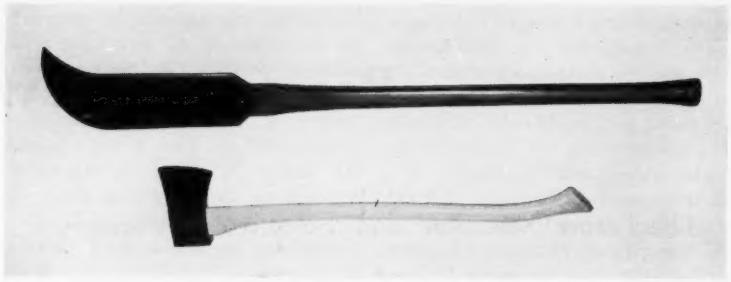

Fig. 1.—Ditch bank tool with axe as yardstick.

Cost: About the same as an axe.

Specifications: There is some variation between pattern in length and width of blades. The blades are appreciably longer, wider, and of a thinner gauge metal than is a brush hook blade. They are of the same gauge as the machete. Unlike the brush hook, both the concave and convex edges are cutting edges. The tool may be filed rapidly to a keen edge (Fig. 1).

Limitations: It is inferior to an axe in severing stems of about three inches in diameter and larger. It is more difficult to keep out of the ground than a machete; hence, in rocky ground where, also, diameter of stems to be severed does not exceed one inch, a machete may be superior.

Advantages: (1) Over the axe: One stroke usually severs many stems in a sprout clump. (2) Over the brush hook: The convex cutting edge of the ditch bank tool. In cutting close to the ground with a brush hook, the woody stems tend to be cradled in the hook concavity and severed partly or not at all. (3) Over both: The ditch bank tool severs slender stems that would be pushed aside by the axe and brush hook. This difference in cutting characteristics of the tools is perhaps best ascribed to the relatively thin gauge metal of the ditch bank tool.

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[1]Published with the approval of the director, Mississippi Agricultural Experiment Station as Journal Article No. 700.

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Points of View

The Terms "Selection" and "Selective" in Forestry

Few problems of forest terminology have evoked so much discussion and confusion as the usage of the terms *selection* and *selective*. These words have come to be used in so many senses as to make effective communication difficult between even well-trained professional foresters. It is high time that an effort be made to define these terms so as to take into account their ordinary usage by foresters.

The verb *select* is taken directly from the Latin word of the same meaning, *selectus*, the past participle of the verb *seligere*. It is defined by the New International Dictionary: "to take by preference from among others, to pick out, to cull." Keep in mind this basic definition. It is probably the only one on which foresters can agree. *Selection* is the corresponding noun and *selective* is the corresponding adjective.

Some purely grammatical points may be made at this juncture. First, it is patently absurd to assign one meaning to the adjectival form and another to the noun of the same root. Notwithstanding, silviculturists have tried hard and long to distinguish between *selection cutting* and *selective cutting*. The failure of their efforts, at least as far as effective communication between foresters is concerned, only serves to prove the point.

Second, nouns should be modified by adjectives. *Selective cutting* is thus a good grammatical term. In the absence of a comfortable adjective, a noun can be used in its attributive sense as an adjective. Since we do have a comfortable adjective here, however, the use of the noun modifier in *selection cutting* is grammatically poor. There is justification for the term *selection method* as it is a contractual form of *method of selection*. Because the educated forester would hardly speak of *cutting of selection*, though, *selective cutting* and not *selection cutting* is the correct term.

Selection was early accepted as a silvicultural system in forestry writings in the English language. I have made no particular attempt to determine the first writer to use the term as a synonym for the *plenterwaldbetrieb* of the Germans and the *méthode de jardinage* of the French. It is sufficient that William Schlich treats the *selection system* in the volume on silviculture of his "Manual of Forestry" in 1891; and that Gifford Pinchot writes of the *selection forest* in his discussion of the Biltmore Forest in 1893.[1] Both used the term in its modern sense as describing the system of silviculture aimed at the development and maintenance of an uneven-aged forest stand.

Over the years, however, many other uses of the root *select* have been used in silviculture. At the present time, it is being used by competent and educated foresters in the senses listed below and possibly in still others:

1. Referring to a silvicultural system. The *selection system* is a method of high forest management characterized by light partial cuts being made periodically in an uneven-aged stand for the purpose of perpetuating the uneven-aged condition. The partial cuts are thus continued indefinitely, there being no intent on the part of the forest manager of ever clearcutting the overwood in a single operation. The individual partial cutting in this system is termed *selection cutting*.

2. Referring to a single cutting operation unrelated to a silvicultural system. (1) *Selective cutting* may refer to any partial cut made for any reason. (2) Sometimes it is construed to mean logger's choice. He selects. (3) In other situations, the term is used, as by the public relations man and the lay public, to imply "good forestry" as distinguished from "bad forestry" or "destructive logging."

3. Referring to the fact that the trees to be cut or left are marked by a forester. In certain methods-of-cutting experiments, the term *selection cutting* is not used in the sense of 1 above, but rather simply to point out that the trees were chosen and marked, in contradistinction to comparable cuts made on a diameter-limit or logger's choice basis.

4. Referring to a type of thinning. Here the usage is highly confusing. (1) Hawley and Smith in the sixth edition of "Practice of Silviculture" recognize *selection thinning* as a major type of thinning comparable to low thinning, crown thinning, and mechanical thinning. The term refers to a particular type of thinning in which the cutting is concentrated in the largest and most valuable trees. (2) In recent silvicultural papers, however, *selective thinning* has been used to characterize a thinning in which the trees have been chosen and marked by the forester, rather than chosen on some mechanical basis as in a row or strip thinning. This meaning is similar to that given for selection cutting in 3 above. (3) A related

[1] Pinchot, Gifford. Biltmore forest. Chicago. 49 p. 1893.

usage characterizes *selective thinning* as one in which the forester varies his marking practice to suit the conditions he finds, rather than restricting himself to the formal application of either low thinning or crown thinning rules.

If the above listing seems confusing, it simply reflects the existing confusion in usage. As a matter of fact, we could complicate things further by simply continuing with other terms in which a second modifier has been added (i.e. *improvement selection system*) and similar terms used by the forest geneticist (i.e. *mass selection*).

The list as it stands, however, suffices to show that the adjective *selective*, or less properly the noun *selection*, is used without additional modifiers in many different senses to characterize a type of cutting or logging operation. Furthermore, many of these uses have little in common with the classifical use of the modifier in forestry in the term *selection system* which refers to a very particular type of management characterized by a series of operations rather than by any single cut.

Actually, none of the terms in the above list is incorrect, unless it be *selection cutting* or *selection thinning* for grammatical reasons. In each case the act of selection is involved: some trees are cut and others are left. Without additional modifiers, nothing else can be implied. The fault lies not with the terms, then, but with the definitions—with efforts to imply a particular purpose or type of selection that is not specified by the term itself. Herein lies the source of the confusion. *Selective cutting* may mean almost anything and each speaker and listener is apt to apply subconsciously any one of a variety of interpretations. Since the interpretation intended by the speaker (or writer) is frequently different from that adopted by the listener (or reader), communication fails.

What, then, is the solution to this problem of terminology? The answer is twofold:

First, the root *select* is widely and properly used in forestry in a number of different senses. All of these senses are in accordance with the dictionary definition "to choose or pick out in preference to another or others" (Oxford). It seems futile to try to restrict such a common word to any single technical sense. It is futile to try to define the adjectival form differently from the noun. In short, we as foresters must adopt the general English meaning of the root *select* whether it be used as an adjective, a noun, or even as a verb. Most importantly, we should try not to assign any implied meaning as to the type, the purpose, the ethical value, or any other quality of the selection.

Second, additional meaning can only be communicated without ambiguity through the addition of an additional modifier. *Economic selection* and *marginal-tree selection* are good examples of such qualified terms that express a clear concept in precise terms. As a result, there have been few arguments or disagreements as to the meaning of these terms.

If we accept the two basic principles outlined above, we are left with *selection* and *selective cutting* (but not *selection cutting*) as valid terms in silviculture, but terms with a general rather than a specific meaning. It then remains to agree upon substitute terms to express the important specific concepts formerly defined by alternative meanings of the above terms. In conforming with the "citation principle" of Merriam-Webster's dictionaries, these terms should be chosen in so far as possible from language in present-day use by English-speaking foresters. Narrow definitions of words commonly used in a broad sense should be avoided, and new terms should be coined only as a last resort.

Confining ourselves for purposes of illustration to the four uses of *selection* listed above, the following set of definitions are proposed:

1. *Uneven-aged management:* A system of silvicultural management involving selective or partial cuts repeated at intervals with the object of creating and maintaining an uneven-aged forest stand. Syn. *selection method, selection system.*
2. *Selective cutting:* Any cutting in which trees are marked or otherwise chosen for removal in preference to other trees that are left uncut. Syn. *partial cutting.*
3. *Marked-tree cutting:* A specific type of selective cutting in which the choice of the trees to be cut or left involves the independent judgment of the forester, as opposed to partial cuts based upon arbitrary rules.
4. *Thinning:* A type of selective or partial cut made for the purpose of stimulating the growth of the residual trees as opposed to partial cuts made for the purpose of realizing stumpage values or for the purpose of obtaining natural reproduction. Since all thinning involves the act of selection, the term *selective thinning* is both redundant and confusing, and should be avoided. Specific types of thinning can be indicated by carefully chosen modifiers (i.e. *crown thinning*).

The usages suggested above are believed to be essentially in conformity with those of practicing foresters in the United States. Their adoption is urged in the hope of reducing the present confusion resulting from the use of the terms *selection* and *selective* in specific technical senses not justified either by the words themselves or by the common understanding of professional foresters.

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Reviews

An Introduction to the Forest Soils of the Douglas-Fir Region of the Pacific Northwest

By the Forest Soils Committee of the Douglas-Fir Region. 230 pp. lithoprinted. University of Washington, Seattle. August 1957. $1.

The intelligent interest of public forest agencies and of wood-using industries in basic soil management as related to forest production in the Pacific Northwest is manifested in this elementary textbook with its regional slant. The cooperating forestry agencies through their forest soils committee (George Schroeder, Crown Zellerbach Corporation, chairman; S. P. Gessel, University of Washington, secretary) are to be congratulated on such a major compendium of knowledge that should do much to disseminate specialized soils knowledge to practicing foresters.

The scope of the work is actually greater than is indicated by the title. The two longest and most complete chapters deal respectively with the geology of western Oregon, Washington, and British Columbia, and with the vegetation and phytogeography of the Douglas-fir region. Both subjects are discussed with regard to their bearing upon the soils, but both are worthily summarized in their own right.

The two-thirds of the manual that relates to soils *per se* follows conventional lines in dealing with such topics as physical properties, chemical properties, soil biology, organic matter, soil-site relationships, soils and forest management, water production, and engineering aspects. In large measure, these chapters consist of brief and elementary presentations of materials found in standard soils textbooks, except that illustrations applying to the Douglas-fir region are included whenever possible, and that literature dealing with the region is cited and discussed.

Perhaps the strongest impression created in the mind of the reader —and one that the authoring committee undoubtedly had in mind to communicate—concerns the scarcity of information available on the forest soils of the Pacific Northwest. The two chapters dealing with physical and chemical properties, for example, contain not a single citation of a research paper dealing specifically with the region. In fact, only about a dozen of all the papers cited in all the chapters are based upon forest soil investigations in the Douglas-fir type. This strictly regional compilation thus constitutes one of the strongest arguments for a generalized fundamental research program. Without the benefit of basic research that has been carried out in other parts of the world, there could have been no such valuable summary for the Douglas-fir region at this time. In fact, it is safe to say that some nine-tenths of the information presented here is covered in somewhat greater detail in the textbooks which, according to the committee, do not cover the Northwest.

The present compilation, however, does demonstrate the success of the forest soils committee in stimulating current work in forest soils. Virtually all the papers cited from the Northwest date from the past decade, and most from the past few years. Soil scientists in the area are actively tackling such vital problems as soil-site correlations, the nutritive requirements of important trees, and management problems of soil compaction. Perhaps nowhere else in the country is so much being done today in comparison to that which was known yesterday.

The fact that the work is a compilation—although credits for the individual sections are not assigned in many instances—results both in a work of high average quality, and one very uneven in the quality of its component parts. The mean is high, but the standard deviation great. Drawing upon the best qualified men in the region for contributions in their respective fields, the committee has generally succeeded in achieving an authoritative and high quality presentation. At the same time, the very number of the contributions has led to considerable variation in presentation. Some sections are clearly rewrites of standard text and lecture presentations while others represent original thinking and a summary of current work in progress. Inevitably there is some redundancy, some omissions, and some contradictions as between the various contributions. Typographical errors and even misspelled words and grammatical errors are not uncommon. Occasional lapses into technical jargon are made at least partially comprehensible by the inclusion of detailed glossaries of terms used in geology and soils.

All in all, however, *An Introduction to the Forest Soils of the Douglas-Fir Region of the Pacific Northwest* is a much needed and welcome addition to our literature, and one that should stimulate even further the excellent work being carried forward in this important field.

STEPHEN H. SPURR
University of Michigan

America's National Parks

By Nelson Beecher Keyes. 256 pp. Illus. Doubleday and Company, Garden City, N. Y. 1957. $7.50.

This is primarily a picture book designed to give a brief and tantalizing introduction to the national parks of North America. The text is short and supplemented by excellent color and black and white photographs which give the reader a quick sampling of the interesting spots of each park.

All of the national parks of the United States have been included plus Hawaii, Mount McKinley, and even the new Virgin Islands National Park. The National Parks of Canada have a separate section in the book. These Canadian parks are often overlooked in literature on parks of North America, and their inclusion here demonstrates pictorially that the nine parks of Canada which are covered are equal to those of the United States in charm and scenic standards.

It is evident that the author and the publisher anticipate that a review of the book will interest readers in seeing these natural wonders at first hand. The pictures are well done so this may well be true. To the critical eye of this reviewer, as an old timer in the National Park Service, the selection of the high points for each park leaves something to be desired. For example, Yellowstone's wildlife illustrations are confined to bears and buffalo, ignoring the elk, antelope, coyote, and other animals which make Yellowstone Park one of the truly great wildlife sanctuaries of the world. Also, it must be recognized that each individual forms his own opinion of what is important and selects illustrations accordingly.

There are a number of minor errors in the text which detract from its authenticity; however, these points are not significant to the extent that they detract from the general attractiveness and appeal of the book. It would have been helpful if the text had included a statement as to how additional information about each park could be obtained. This would have been particularly appropriate for the Canadian parks. Similarly, other striking omissions in the text are (1) failure to mention the Mission 66 Program for the parks of the United States which was designed to make the parks more usable for the visitors which the book hopes to lure to them; and (2) the Park Interpretive Programs which are an integral part of every major park.

Generally, however, the effect of *America's National Parks* is good and quite attractive.

Lemuel A. Garrison
Superintendent, Yellowstone National Park

Franklin D. Roosevelt and Conservation, 1911-1945

Compiled and edited by Edgar B. Nixon. 2 vols. 1,314 pp. Franklin D. Roosevelt Library, Hyde Park, N. Y. $9.50.

These two volumes represent a new procedure in the publication of Presidential papers. Heretofore publication has customarily consisted of a monolithic chronological arrangement of all material. It has usually not reached print until some decades after the President left office, giving time for other persons intimately concerned to leave the scene. The very mass of F.D.R.'s accumulated personal and official papers required a different approach—one based on subject matter. The process of extraction and selection likewise made early publication feasible. Such an approach led quite logically to the choice of conservation of natural resources as the subject of the first documentary publication of the Roosevelt Library. Volumes on other subjects will follow.

The result of this screening is a collection of material that has historical value and reader interest. The volumes will prove of great aid to those who would trace developing resource policies and program patterns through an important period of United States history and one in which much emphasis in public programs was given to resource conservation. Footnotes and detailed indexing make reference use easy. But aside from this value, which alone more than justifies publication, the volumes make very good reading for anyone with an interest in conservation, in the New Deal era, or in Franklin D. Roosevelt as an individual.

Containing almost twelve hundred letters, memoranda, press conference reports, and speeches, the collection includes, according to the publisher, "all of Roosevelt's significant writings on the conservation of soil, water, forests, wildlife, and wilderness and scenic areas, as well as the more important letters addressed to him on these subjects." Most of the material deals with the period 1933-1945, although a hundred or more items cover Roosevelt's earlier years as a farm and forest owner at Hyde Park, a member of conservation organizations, and New York state senator and governor. Topics such as the Civilian Conservation Corps, enlargement of the national forest and national park systems, the shelterbelt project, the TVA, federal forest policy of that period in general, the history of conservation legislation and Roosevelt's part in it—all will ring a bell for the student of conservation history.

The Society of American Foresters is mentioned several times and the names of individual foresters pop up all over the place.

Because of the very nature of the volumes, personal papers of a President of the United States, the reader has a sense of on the spot observation of history in the making and of insight into the personalities of its makers.

Franklin D. Roosevelt and Conservation is interesting reading and a valuable addition to historical records of this country's efforts in the field of natural resource conservation.

Arthur B. Meyer

The Biltmore Immortals: Volume II

356 pp. Illus. Preface by Howard R. Krinbill, Webster, N. Y.

When Dr. C. A. Schenck, director of the Biltmore Forest School during the period of its existence from 1898 to 1914, wrote the preface to the first volume of *The Biltmore Immortals* (reviewed in the JOURNAL for April 1954) he promised that a second volume was to come. Dr. Schenck did not live to see that second volume completed for he died May 15, 1955. His former students completed the work and Volume II has now been published.

Dr. Schenck's own life story is the first discussed in this new volume. It is followed by biographical and autobiographical sketches of 22 Biltmore graduates, 10 lecturers, and 3 friends of the school. Of the 22 graduates' stories. two are continuation of memoirs begun in Volume I. Not all of the graduates stayed in forestry work but whether or not they did an unusually large proportion of all graduates seem to have enjoyed successful, happy careers, bearing out the high regard Biltmore students have always displayed for their teacher.

In memory of Dr. Schenck the Biltmore alumni and friends gathered at the North Carolina State College to dedicate the Carl Alwin Schenck Memorial Forest. The complete program of that dedication concludes the volume.

No price is indicated for this volume, but the first was printed by L. C. Wittich, Darmstadt, Germany; $10.

Publications of Interest

The second edition of *Forestry Handbook of British Columbia,* published by the Forest Club of the University of British Columbia, will be for sale by spring 1959. The 600-page handbook is intended to be a practical referenece guide for all foresters in the Northwest both in the field and office.

Added to the second edition are sections on forest photogrammetry, watershed management, forest products, range management, wildlife management, recreation, and busheraft. An equipment directory will also be added. Former sections which have been substantially revised are: silviculture, entomology, forest associations, forest measurement, and fire control. Tabular data include revised volume and yield tables.

* * *

Foresters and land managers interested in aerial photo interpretation may obtain a review of basic techniques in *Forester's Guide to Aerial Photo Interpretation* by Gene Avery. It is written primarily as a practical reference on the application of aerial photographs in forest inventory. Emphasis is on stereoscopic interpretation of 1:20,000 panchromatic photographs available from various government agencies. The handbook tells how to order prints and prepare them for viewing, and lists minimum equipment required for interpretation. Many of the fundamentals are clarified by illustrations, and a number of helpful tables are included. The publication, Occasional Paper 156, is available from the Southern Forest Experiment Station.

* * *

Cynipid Galls of the Pacific Slope, an aid to the identification of cynipid insects which attack oak, is designed for field use and easy identification. It contains a synoptic list of the 191 Cynipoidea described or recorded from the Pacific Slope, a host index of the gall making species, a table listing all the oak gall-makers by part of plant affected and hosts on which each occurs, and 171 illustrations of galls with the name, where known, of the cynipid forming them. The publication is for sale by its author, 6613 N. Washington Blvd., Arlington 13, Va., or by R. J. Lyon, Los Angeles City College, 855 North Vermont Ave., Los Angeles 29, Calif. The price is $1.

* * *

A new U. S. Department of Agriculture manual on maple sirup discusses all phases of producing maple sap, maple sirup, and maple products. The manual, by C. O. Willits of the Agricultural Research Service's Eastern Utilization Research and Development Division at Philadelphia, Pa., provides easy-to-follow directions for each processing step. It is believed to be the first comprehensive publication devoted primarily to the processing of maple sap to maple sirup and related products. Copies of *Maple Sirup Producers Manual,* Agricultural Handbook No. 134, are also for sale by the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C., at 60 cents each.

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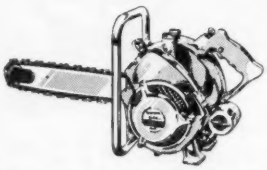

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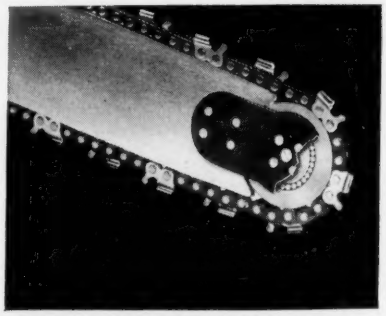

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Current Literature

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General

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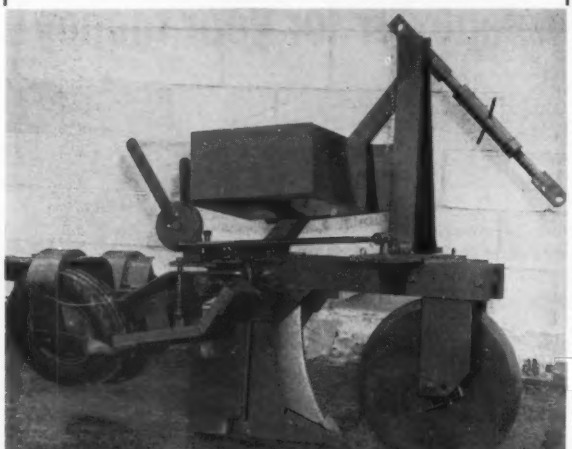

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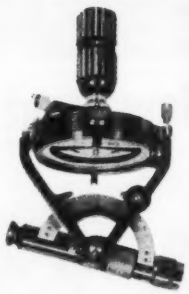

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Relation of Time of Planting to Establishment of Wheat Grasses in Northern New Mexico. By H. W. Springfield. 9 pp. Rocky Mountain Forest and Range Expt. Sta., Fort Collins, Colo. 1956. Res. Note No. 24.

Some Results of Seedling and Fertilization to Improve Southern Forest Range. By L. K. Halls, G. W. Burton, and B. L. Southwell. 26 pp. Illus. Southeastern Forest Expt. Sta., Asheville, N. C. 1957. Sta. Paper No. 78.

Warm Season Grasses in Kansas. By F. G. Bieberly, E. A. Cleavinger and L. E. Willoughby. 16 pp. Kansas Agric. Ext. Serv., Manhattan. 1957. Cir. No. 258.

Silviculture

A Comparison of Two Rodent Repellents in Broadcast Seeding Douglas-Fir. By E. J. Dimock II. 17 pp. Illus. Pacific Northwest Forest and Range Expt. Sta., Portland, Ore. 1957. Research Paper No. 20.

The Growth and Yield of Aspen in Saskatchewan. By C. L. Kirby, W. S. Bailey, and J. G. Gilmour. 67 pp. Illus. Saskatchewan Dept. of Natural Resources. Forestry Branch, Regina. 1957. Tech. Bul. No. 3.

Silvical Characteristics of American Elm. By P. C. Guilkey. 19 pp. Lake States Forest Expt. Sta., St. Paul, Minn. 1957. Sta. Paper No. 54.

Silvical Characteristics of Cherrybark Oak. By Thomas Lotti. 9 pp. Illus. Southeastern Forest Expt. Sta., Asheville, N. C. 1957. Sta. Paper No. 88.

Silvical Characteristics of Flowering Dogwood. By J. P. Vimmerstedt. 11 pp. Southeastern Forest Expt. Sta., Asheville, N. C. 1957, Sta. Paper No. 87.

Silvical Characteristics of White Spruce. By Hans Nienstaedt. 23 pp. Illus. Lake States Forest Expt. Sta., St. Paul, Minn. 1957. Sta. Paper No. 55.

Soils

Forest Soils; Their Properties and Relation to Silviculture. By S. A. Wilde. 537 pp. Illus. Ronald Pr., New York. 1958. $8.50.

Some Effects of Logging and Slash Burning on Physical Soil Properties in the Corvallis Watershed. By C. T. Dyrness, C. T. Youngberg and R. H. Ruth. 15 pp. Pacific Northwest Forest & Range Expt. Sta., Portland, Ore. 1957. Research Paper No. 19.

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The Importance of Preservative Treatments in Hardwood Utilization. By N. Tamblyn. 15 pp. Australia Commonwealth Div. of Forest Products, Canberra. 1957. Reprint No. 334.

Preservative Treatment of Jack Pine and Longleaf Pine Posts by the Hot-and-Cold Bath and Its Boiling-in-Water Adaptation. By Edward Panek. 6 pp. Forest Products Lab., Madison, Wis. 1957. Rept. No. 2085. Mimeog.

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Bending Solid Wood to Form. By E. C. Peck. 37 pp. Illus. U. S. Dept. of Agric., Washington 25, D. C. 1957. Agric. Handbook No. 125. 15 cents (Govt. Print. Off.).

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Primary Wood Use in New York; A Survey of Industrial and Non-Industrial Use of Roundwood. By E. F. Von Ohlsen, S. H. Coontz and K. C. Compton. 75 pp. State Univ. College of Forestry, Syracuse, N. Y. 1957. Bul. No. 40. 70 cents.

Some Machining Properties of Nine Liberian Hardwoods. By E. M. Davis. 4 pp. Illus., tables. Forest Products Lab., Madison, Wis. 1957. Rept. No. 2093.

Tree Growth Characteristics and Their Influence on Wood Structure and Properties. By H. E. Dadswell. 19 pp. Australia Commonwealth Div. of Forest Products, Canberra. 1957. Reprint No. 333.

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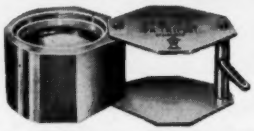

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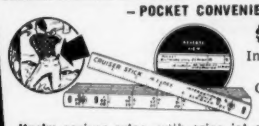

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The Council's Column

Professional Responsibility

This freshman member of the Council has often heard our members say that, in its avoidance of controversial policy matters, the Society is not living up to its professional responsibility. This charge has been leveled at both the Society nationally and at the Sections. Since widespread organization of Chapters, many of them have waded right into controversial topics and debated them long and loud. Chapters have thus given our membership much greater chance for professional expression. This, however, can't wholly satisfy the apparent need for policy discussion and action at Section and national levels.

There was a time when the annual meetings devoted at least half a day, and sometimes a full day, to policy matters. During the height of the controversy over whether forestry was to be practiced voluntarily by landowners or under federal law this was certainly the case.

More recently, since the annual meeting has become a "meeting of many meetings" because of the 6- or 7-ring circus of subject Divisions, we just do not have opportunity for rous-

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ing policy sessions as of old. There seems to be little time for other than the usual general regional review for the benefit of the visitors, annual reports of Society staff, committees, etc. Less frequently of recent years have the general sessions devoted time to pertinent Society matters such as the requirements of grades of membership, or the licensing of foresters.

It is the writer's opinion that to fulfill our professional obligations, the Society of American Foresters must courageously discuss controversial issues and evaluate all important policy proposals. The public and its policy-making arms of the Congress and the legislatures of the several states want and need our guidance in forestry matters. If we do not hammer out our own beliefs by the tried and true American process of full and open discussion and let them be known, we shirk our professional responsibility. We may, by default, find ourselves working under policies laid down by those who do not have the technical knowledge necessary for the constructive guidance of forestry in our country.

To cite examples of important controversial items which could have been discussed in general sessions at annual meetings of the Society and by the Sections in the last several years, there was Task VIII of the Timber Resource Review, the pending proposals for a Federal Forest Products Price Reporting Service, and a National Wilderness Preservation System, Titles I and IV of the Soil Bank Act, and the serious problems posed by Dr. Fairfield Osborn's intimation at the Syracuse meeting that certain insecticides used for forest insect control should be prohibited. And there will be others.

As men dedicated to the advancement of forestry, can our professional Society do less than study, discuss, and publicly state our professional viewpoint on all matters which will affect the timber, water, and wildlife resources and recreational opportunities of future generations?

W. D. Hagenstein

Index of Forestry Theses Planned

The Society of American Foresters and Oregon State College will jointly sponsor an indexing of forestry theses titles to provide a broad coverage of technical literature generated by graduate studies at the nation's forestry

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All institutions in the United States granting advanced degrees in forestry are requested to submit to the Librarian, Oregon State College, Corvallis, by June of each year a list of forestry theses accepted by them. Biographical information should be provided and should include: author (given names in full), thesis title, degree granted, date degree granted, and the name of the institution granting the degree. For further information, write directly to the OSC librarian.

Foresters who have written theses accepted by any institution in the United States are also asked to provide the same information to the librarian to prevent omission of any forestry theses on file in the United States.

Previously the Oregon State College Library has sponsored two indices in cooperation with the School of Forestry. These are available at $1 per copy from the Director of Publications, Oregon State College.

Division of Silviculture Call for Papers

The annual meeting of the Division of Silviculture will be held Sept. 30, Salt Lake City, Utah. It will consist of a morning and afternoon session, with over half of the program reserved for volunteer papers.

All members of the Society who wish to read papers before the Division should send in complete titles and a short abstract of the proposed papers, together with the name and address of the speaker and the organization he represents, on or before May 15 to the chairman, James D. Curtis, U. S. Forest Service, Ogden, Utah.

Members who submit titles for inclusion in the program are reminded that the subject chosen should be one that belongs properly in the Division of Silviculture.

The program will be made up by the executive committee of the Division by selection of papers from among the titles submitted, without regard to order of receipt. In order to provide opportunity for as many as possible to participate in the meeting, preference will be given to papers that can be presented in 12 minutes or less. No paper that requires more than 20 minutes can be considered. Authors of papers selected for the meeting will be notified as soon as possible, but in any case by June 15. This is the only call for papers that will be issued by the Division of Silviculture.

RICHARD D. ROSEBERRY
Secretary

Allegheny Section Holds Winter Meeting

With an attendance of 180 members and guests the Allegheny Section held its winter meeting February 13-15 at Pittsburgh, Pa., in the Penn-Sheraton Hotel. Evening registration February 13 preceded a day and a half of sessions devoted to the theme "Forests and People." This theme was explored by four discussion panels

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whose subjects and participants were as follows:

"How to Get Along With People." Panel members D. B. Bonebrake, Paul R. Beatty, Adna R. Bond, and Hamilton K. Pyles.

"How to Supervise People." Panel members Ephe M. Oliver, J. S. Illick, Lester McClung, and Ray F. Bower.

"People and Forest Recreation." Panel members John F. Shanklin, William A. Parr, and Arthur C. Bachman.

"How to Inform People." Panel members Alden T. Cottrell, L. S. Hartley, Arthur McIntyre, Harold D. Ellis, and Austin N. Lentz.

Two short business sessions were interposed at appropriate periods.

At the annual banquet of the Section William A. Parr presided as toastmaster. Professor Harold Zelko of the Department of Speech of Penn State spoke on the general subject of human relationships in an interesting and instructive way.

Officers for 1958 were installed at the banquet as follows: W. W. Ward, chairman; William A. Parr, vice chairman; Paul Felton, secretary-treasurer; and William A. Parr, membership chairman.

Appalachian Section Honors C. H. Flory, R. C. Winkworth

An achievement award for outstanding contributions to the profession of forestry was presented to South Carolina State Forester Charles H. Flory of Columbia on February 14 in Raleigh, N. C. at the 37th annual meeting of the Appalachian Section.

Each year the Section presents a senior award to an outstanding forester over 40 years of age and a junior award to one under 40 years of age. This year's junior award was presented to Ralph C. Winkworth of Raleigh, regional forester of the North Carolina Department of Conservation and Development.

Northern California Section Has Winter Meeting

Some 250 members of the Northern California Section met in San Francisco December 7 for their annual winter meeting, dedicated this year to an examination of the forest management problems created by a rising tide of recreation pressure. Keynoting the issues, Myron Krueger, professor emeritus of forestry at University of California, opened the day's proceedings with a warning that California can ill afford to let recreational uses of forest land dominate other uses.

A panel of speakers defined recreational problems they must deal with. Speakers were: W. S. Davis, U. S. Forest Service; Robert V. Golden, the Sierra Club; R. R. Waterer, chief conservator of forests of Kenya, British East Africa; Dietrich W. Muelder, visiting professor of forestry at University of California; and Elmer Aldrich, executive officer of the California Outdoor Recreation Plan committee.

A panel of speakers which took up applied recreation management on forest land was comprised of Walter Puhn, supervisor of the Sierra National Forest; M. E. Thede, regional forester for the National Park Service; Gray Evans, land and timber manager for Hammond-California Redwood Company; William Beaty, timberland manager for Shasta Forest, Inc.; and Dean Schlobohm, forest technician for the California Division of Forestry.

Two speakers described tools that may help recreation-area managers: Robert Colwell, professor of forestry at University of California, and Richard Gearhart, manager of Frontiers, Inc.

H. C. Abraham was program chairman; Myron S. Wall, Jr., Section chairman, presided.

Southern California Section Meets

The fall meeting of the Southern California Section was held December 6-7 at the Green Hotel in Pasadena with Chairman David Rogers presiding.

Section business included a discussion of the licensing of foresters in California. It was decided to send

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questionnaires to Section members on this subject.

Craig Chandler of the California Forest and Range Experiment Station acted as moderator of a panel discussion on the new "Operation Fuel Break" project. Panel members were Jay Bentley, project leader; Charles Yates, San Bernardino National Forest; John Hastings, California Division of Forestry; and Roland Percy, Los Angeles County Fire Department. This project is a cooperative fire protection program involving cover manipulation to break up large brush fields.

Dr. James C. Bonner, California Institute of Technology, spoke at the evening banquet.

On the second day, field trips were conducted to the Los Angeles County Nursery at Henninger Flat and the County Arboretum at Arcadia.

Section Officers

"To hold office in any Section of the Society these days is a simultaneous honor and responsibility. Our Society membership is the group of professional men to whom the public and industries now turn for results. The period for promoting the idea of practicing forestry has gone by and we are now in a period of accomplishing the things that the old crusaders among us kept urging should be done.

"This new era in forest land management practice and policy is giving us a stature in the nation and locally that we as professional men never had before. We must not fail! We must be equal to the challenge. Who else is there to lead the thought and policies for the practice of forestry in our country?"

FROM THE NEW YORK FORESTER

Membership Applications and Advancements

Proposals for admission, advancement, and reinstatements received in the Society office during the month of February are listed below.

Action on the eligibility of those proposed for membership as listed below will be taken by the Council as of May 1958.

Communications from voting members regarding the membership eligibility of these persons should be received in the Society office prior to that date.

Allegheny Section

Student Grade

PENNSYLVANIA STATE UNIVERSITY

Durkas, A. P.

WEST VIRGINIA UNIVERSITY

Lantz, T. H. Yokum, O. K.

Junior Grade

Souders, B. M., Forester, Self Employed, Mt. Pleasant, Pa.; Pa. State, B.S.F., 1949.

Vanaman, J. O., Asst. Eng., N. J. Dept. of Cons. & Dev., Greenbank, N. J.; State Univ. of N. Y., B.S.F., 1956.

Students Eligible for Automatic Advancement

WEST VIRGINIA UNIVERSITY

Dill, R. E. Kiser, A. W.

Member Grade

Ewers, J. F., Co. Forester, Hardes Lbr. Corp., Bradford, Pa.; Pa. State, B.S.F., 1949. (Junior 1954).

Lang, F. W., Asst. Dist. Forester, Dept. of Forests & Waters, Bloomsburg, Pa.; Pa. State, B.S.F., 1948. (Junior 1954).

Appalachian Section

Member Grade

Carney, R. G., Co. Forester, N. C. Dept. of Cons. & Dev., Statesville, N. C.; Pa. State, B.S.F., 1950. (Junior 1954).

Craft, A. C., Forester, W. Va. Pulp & Paper Co., Lake City, S. C. (Junior 1950).

Affiliate Grade

Cooler, E. W., Nurseryman, Piedmont Nursery, Pickens, S. C.

Central Rocky Mountain Section

Student Grade

COLORADO STATE UNIVERSITY

Johnson, F. R. Stiger, E. M.

Junior Grade

Serino, R. G., Forester, USFS, Custer, S. D. (Reinstatement).

Students Eligible for Automatic Advancement

PURDUE UNIVERSITY

Baumgardner, R. E. Wolf, J. B.
Hinton, O. W.

Member Grade

Wadlow, G. D., Forester, USFS, Walden, Colo.; Colo. State, B.S.F., 1949. (Junior 1954).

Columbia River Section

Student Grade

OREGON STATE COLLEGE

Bialkowsky, K. W. Newton, M.
Bousfield, W. E. Peters, C. E.
Buffam, P. W. Robles, R. K.
Meyer, K. R. Swain, K. M.
Zontek, E. F.

Junior Grade

Barrett, G. W., Research Forester, USFS, Bend, Ore.; Iowa State, B.S.F., 1945, M.S. (Forest Pathology), 1947.

Member Grade

Boris, A. J., Forester, Prineville, Ore. (Junior 1951).

Condon, T. H., USFS, Oakridge, Ore. (Junior 1951).

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Graham, D. A., Creswell, Ore. (Junior 1951).
Hubbe, G., USFS, McKenzie Bridge, Ore. (Junior 1951).
Jones, W. L., Forester, USFS, Detroit, Ore.; Ore. State, B.S.F., 1954. (Junior 1954).
Links, T. A., Forester, Brooks-Scanlon Inc., Bend, Ore. (Junior 1951).
Schaufler, P. G., USFS, Sisters, Ore. (Junior 1951).
Schramek, R. W., Forester, USFS, Seneca, Ore.; Univ. of Minn., B.S.F., 1954. (Junior 1954).
Sorber, R. P., Asst. Ranger, USFS, Jacksonville, Ore. (Junior 1951).
Urie, D. H., Soils Dept., Corvallis, Ore., Ore. State. (Junior 1951).
Willey, R. M., Forester, Bate Lbr. Co., Grants Pass, Ore. (Junior 1951).

Affiliate Grade

Mosher, A. E., Asst. to Logging Eng., Willamette Valley Lbr. Co., Dallas, Ore.

Gulf States Section

Junior Grade

Fate, D. W., Asst. Dist. Forester, Texas Forest Service, Lufkin, Texas; Purdue, B.S.F., 1951.
Thomas, J. L., Forester, USFS, Oxford, Miss.; Univ. of Fla., B.S.F., 1950.

Students Eligible for Automatic Advancement

LOUISIANA POLYTECHNIC INSTITUTE

Henderson, D. W. Reed, A. W.

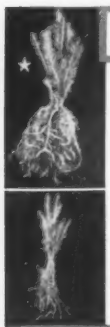
Member Grade

Alexander, D. S., Forester, Gaylord Container Corp., Bogalusa, La.; Colo. State, B.S. (Forest Util)., 1954. (Junior 1954).
Bloomer, D. H., Forester, USFS, Gulfport, Miss. (Reinstatement).
Cameron, D. C., Asst. Dist. Forester, Gaylord Container Corp., Denham Springs, La. (Junior 1951).
Christopher, J. F., Research Forester, USFS, New Orleans, La. (Junior 1951).
Clark, J. D., Chief Forester, Fisher Lbr. Co., Wisner, La. (Junior 1951).
Evans, W. B., Dist. Forester, T. L. James & Co. Inc., Pineville, La. (Junior 1951).
Follen, W. F., Sales Mgr., Hood Mfg. Co., Jackson, Miss. (Junior 1951).
Goebel, G. E., Cons. Forester, Gaylord Container Corp., Jackson, Miss. (Junior 1951).
Hammarstrom, C., Consulting Forester, Bude, Miss. (Junior 1951).
Hanson, N. F., Forester, E. L. Bruce Co., Bruce, Miss. (Junior 1954).
Hollomon, E. A., Dist. Forester, Masonite Corp., Collins, Miss. (Junior 1951).
Holman, J., Forester, Richton Tie & Tbr. Co., Morton, Miss. (Junior 1951).
Hood, W. L., Dist. Supv., International Paper Co., Mansfield, La. (Junior 1954).
Huff, P. R., Forester, Craig, Huff & Miller, Jackson, Miss. (Junior 1952).
Janssen, H. F., Forester, USFS, Wiggins, Miss.; State Univ. of N. Y., B.S.F., 1950. (Junior 1954).
Kelley, F. G., Unit Forester, International Paper Co., Natchitoches, La. (Junior 1951).
McClurkin, D. C., Soil Scientist, USFS, Oxford, Miss. (Junior 1951).
McDonald, W. R., Adm. Asst., Kirby Lbr. Co., Bellaire, Texas. (Junior 1951).
Mims, J. K., Diboll, Texas. (Junior 1951).
Nachod, L. H., Service Forester, La. Forestry Comm., Hammond, La. (Junior 1951).
Rehling, H. W., Dist. Forester, Texas Forest Service, Henderson, Texas. (Junior 1951).
Smith, D. W., Area Forester, Southern Pulpwood Cons. Assoc., Shreveport, La. (Junior 1951).
Sutton, W. T., Forester, Edgewood Land & Logging Co., De Quincy, La.; LPI, B.S.F., 1953. (Junior 1954).
Williams, F. E., Unit Forester, International Paper Co., Mansfield, La.; Univ. of Ga., B.S.F., 1950. (Junior 1954).

Inland Empire Section

Member Grade

Calhoun, D. C., Range Mgr., U. S. Dept. of Int., Spokane, Wash.; Univ. of Mont., B.S.F., 1954. (Junior 1954).
Dowd, L. W., Work Unit Cons., Soil Cons. Service, Colville, Wash. (Junior 1951).
Lynn, A. D., Forester, Western Pine Assoc., Coeur d'Alene, Idaho. (Junior 1951).
Nobis, R. S., Consulting Forester; Partner, Panhandle Land & Tbr. Co., Coeur d'Alene, Idaho. (Junior 1951).



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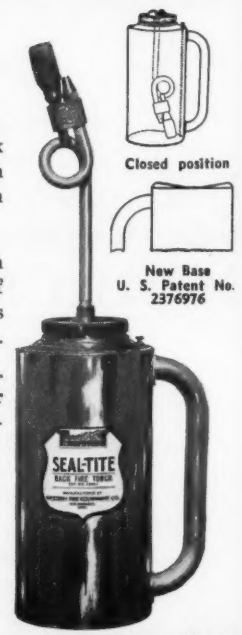

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Stage, A. R., Forester, USFS, Spokane, Wash. (Junior 1951).

Affiliate Grade

Cowles, F. R., Dist. Forest Ranger, USFS, Orofino, Idaho.

Intermountain Section

Junior Grade

Harvey, E. A., Forester, USFS, Ogden, Utah; Utah State, B.S.F., 1957.

Member Grade

Washburn, R. I., Entomologist, USFS, Ogden, Utah; Colo. State, B.S.F., 1948. (Junior 1954).

Affiliate Grade

Mickelson, H. L., Forester, USFS, Salt Lake City, Utah.

Kentucky-Tennessee Section

Affiliate Grade

Collins, F. W., Field Director, Ky. Reclamation Assoc., Earlington, Ky.

New England Section

Student Grade

UNIVERSITY OF MASSACHUSETTS

Foster, T. S. Rose, W. E.

Junior Grade

Longwood, F. R., Research Ctr. Leader, Penobscot Research Ctr., Bangor, Maine; Mich. State, B.S.F., 1938, Ore. State, M.F., 1940.

Member Grade

Sopper, W. E., Forestry Instructor, Pa. State Univ., Pa. State, B.S.F., 1954, M.F., 1955. (Junior 1954).

Thorne, T., Consulting Forester, Self Employed, Center Conway, N. H.; Univ. of Mich., M.F., 1954. (Junior 1954).

Affiliate Grade

Beaujean, K. A., Forest & Park Supv., Mass. Dept. of Natural Resources, Boston, Mass.

New York Section

Member Grade

Cronk, A. G., Mgmt. Trainee, Bur. of Land Mgmt., Wash., D. C.; State Univ. of N. Y., B.S.F., 1954. (Junior 1954).

Guenther, R. Forester, W. Va. Pulp & Paper Co., Covington, Va.; State Univ. of N. Y., B.S.F., 1952. (Junior 1954).

Lake, G. T., Owner, Lake & Lake Lbr. Co., Tupper Lake, N. Y.; State Univ. of N. Y., B.S. (Silviculture & Mgmt.), 1938. (Junior 1954).

Quaile, G. E., Forester, West Va. Pulp & Paper Co., Mechanicville, N. Y.; Univ. of Mich., B.S.F., M.F., 1954. (Junior 1954).

Satterlund, D. R., Asst. Prof. of Forestry, State Univ. of N. Y.; (Junior 1951).

Northern California Section

Junior Grade

Cross, A. H., Div. Forester, Pacific Gas & Electric Co., Red Bluff, Calif. (Reinstatement).

Northern Rocky Mountain Section

Student Grade

MONTANA STATE UNIVERSITY

Challinor, H. C. Saxton, L. F.
Korb, J. W. Schmidt, W. C.
Novak, R. A. Sorenson, F. G.
Raugutt, R. L. Squire, T. G.

Junior Grade

Yuhas, M. L., Dist. Ranger, USFS, Columbia Falls, Mont.; Mont. State, B.S.F., 1951.

Member Grade

Dix, H. R., General Mgr., The Anaconda Co., Bonner, Mont.; Mont. State, B.A. (Forest Mgmt.,) 1929. (Junior 1954).

Ozark Section

Junior Grade
Students Eligible for Automatic Advancement

UNIVERSITY OF MISSOURI

Bunch, S. R. Ferguson, A. J.
Gansner, D. A.

Member Grade

Biswell, C. R., Dist. Ext. Forester, Kansas State College, Hutchinson, Kan.; Univ. of Mo., B.S.F., 1954. (Junior 1954).

Puget Sound Section

Student Grade

UNIVERSITY OF WASHINGTON

Davis, R. A. Miller, R. E.
Eliason, V. L. Proutt, J. M.

Junior Grade

Chapman, R. C., Forester, Weyerhaeuser Tbr. Co., Centralia, Wash. (Reinstatement).

McIntosh, G. W., Forester, Weyerhaeuser Tbr. Co., Chahalis, Wash. (Reinstatement).

Member Grade

Sullivan, L. J., Forester, USFS, Bellingham, Wash.; Ore. State, B.S.F., 1939. (Junior 1954).

Thompson, T. A., Shift Foreman, Columbia Hardwood, Everett, Wash. (Junior 1951).

Affiliate Grade

Roberts, H. R., Forestry Supv., Weyerhaeuser Tbr. Co., Chehalis, Wash.

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Ross, J. R., Forest Officer, Bur. of Indian Affairs, Hoquiam, Wash.

Southeastern Section

Student Grade

University of Florida

Wadsworth, J. B.

University of Georgia

Alsup, J. S. Link, D. D.
Canada, J. I. McEuen, A. R.
Chick, P. P. Preston, D. N.
Farr, L. E. (Reinstatement).
Foster, J. C.

Junior Grade

Shuttleworth, W. S., Forester, USFS, Dahlonega, Ga.; W. Va. Univ., B.S., (Forest Industries), 1957.

Students Eligible for Automatic Advancement

Alabama Polytechnic Institute

Newby, P. W. Pomeroy, J. E.
Rowe, E. E.

University of Florida

Patton, D. W. Sage, R. D.

University of Georgia

Preston, D. N.

Member Grade

Bailey, H. J., Asst. Mgr. Tbr. Dept., Container Corp. of America, Fernandina Beach, Fla. (Junior 1951).

Brislin, H., Procurement Mgr., Republic Creosote Corp., Indianapolis, Ind.; LSU, B.S.F., 1950. (Junior 1954).

Brock, G. A., Forester, International Paper Co., Mobile, Ala.; Univ. of Fla., B.S.F., 1954. (Junior 1954).

Carnes, E. T., Farm Forester, Fla. Forest Service, Madison, Fla.; Univ. of Ga., B.S.F., 1947; M.F. (Silviculture), 1957. (Junior 1954).

Park, G. H., Forester, St. Regis Paper Co., Jacksonville, Fla.; Univ. of Fla., B.S.F., 1954. (Junior 1954).

Riggs, R. H., Supv. Line Clearance, So. Bell Tel. & Tel., Birmingham, Ala.; API, B.S.F., 1950. (Junior 1954).

Wiese, R. F., Asst. Dist. Ranger, USFS, Ocala, Fla. (Junior 1951).

Williams, M. F., Jr. Forester, St. Joe Paper Co., Wewahitchka, Fla.; Univ. of Ga., B.S.F., 1954. (Junior 1954).

Upper-Mississippi Valley Section

Student Grade

Iowa State College

Peters, D. L. Steensen, D. H. J.

University of Minnesota

Borkenhagen, J. E. Heath, W. L.
Grunewald, S. H. Jarvis, E. E.
Hansen, A. J. Oien, W. O.
Westerdahl, W. G.

Wisconsin-Michigan Section

Student Grade

Michigan State University

Crockett, D. B. Holemo, F. J.
Filius, D. A. Kubiske, A. F.
Selinger, J. R.

Junior Grade

Noblet, P. N., Forester, Goodman Lbr., Calumet, Mich.; Mich. College of Mining & Tech., B.S.F., 1955.

Lebo, C. A., Goodman Lbr., Calumet, Mich.; Mich. College of Mining & Tech., B.S.F., 1954.

Member Grade

Barclay, W. H., Farm Planner, Soil Cons. Service, Adrian, Mich. (Junior 1951).

Bassett, J. R., Candidate for Ph.D. in Forestry, Univ. of Mich.; (Junior 1951).

Coltharp, G. B., Candidate for Ph.D. in Forestry, Mich. State. (Junior 1951).

Hause, R. H., Dist. Forester, Kimberly-Clark of Mich., Inc., Pickford, Mich.; Univ. of Mich., B.S.F., 1947. (Junior 1954).

Jones, J. R., Asst. Dist. Ranger, USFS, Park Falls, Wis.; Mich. State, B.S.F., 1954, Univ. of Minn., M.F., 1955. (Junior 1954).

Lord, W. B., Candidate for Ph.D. in Forestry, Univ. of Mich. (Junior 1951).

McCraney, R. E., Dist. Supt., Kimberly-Clark of Mich. Inc., Newberry, Mich.; Univ. of Mich., B.S.F., 1943. (Junior 1954).

McDowell, W. J., Forester, Supv., Northern Tree Co., Petoskey, Mich.; Mich. State, B.S.F., 1939. (Junior 1954).

Young, E. J., Asst. Ranger, USFS, Tawas City, Mich. (Junior 1951).

Young, G. E., Consulting Forester, No. Tree Co., Petoskey, Mich. (Junior 1951).

Affiliate Grade

Fullerton, W. K., Reforestation Supv., Canada Dept. of Lands & Forests, Parry So., Canada.

Coming Events

Columbia River Section

The Columbia River Section will hold its spring meeting in Bend, Ore., April 18-19, with headquarters at the Pilot Butte Inn. Theme: "Intensification in Natural Resource Management Practices."

Forest Products Research Society

The twelfth annual meeting of the Forest Products Research Society will be held June 22-27 at Madison, Wis.

Society of American Foresters

The Hotel Utah, Salt Lake City, will be headquarters for the Society's 58th annual meeting scheduled for September 28-October 1.

American Forestry Association

The 83rd annual meeting of the American Forestry Association will be held in Tucson, Ariz., October 27-30, 1958. Headquarters will be the Pioneer Hotel. Meeting theme: "Water, Forests, and People."

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Forestry News

Fires In National Forests Dropped 42 Percent Last Year

Fires in national forests dropped 42 percent in 1957 from 1956 with man-caused fires hitting a new low, the U. S. Department of Agriculture has announced.

There were 7,200 fires in national forests during 1957, according to preliminary reports from field offices of the U. S. Forest Service. This compares with 12,454 fires in 1956 and a 5-year average between 1952 and 1956 of 10,996. The area burned also dropped from 249,859 acres in 1956 to 133,447 in 1957.

Man-caused fires dropped from 4,775 in 1956 to 3,274 in 1957, establishing the lowest record since 1933 when 3,081 man-caused fires were reported. In 1957 recreation use alone was almost six times what it was in 1933.

The South reported the greatest drop in man-caused fire with 55 percent less in 1957 than in 1956. Many public and private agencies have been waging intensive war against incendiarism in the South during the past two years.

Lake States Foresters Move on New Tree Blight

In a January 21 meeting at Wausau, Wis., federal, state, university, and private foresters and biologists, and owners of Lake States timber lands exchanged observations on a hitherto unfamiliar blight that has appeared on the maple timber of northeastern Wisconsin. The disease, known as maple blight, was first noted in 1956 on some of the extensive hardwood timber stands of Florence County and now is said to be scattered over 10,000 acres. In this area maple trees of all sizes and ages were observed dying from some unknown cause.

As a result of the meeting, a plan for joint action to study the disease was agreed to. The University of Wisconsin will investigate the entomological and pathological aspects of the blight. The Lake States Forest Experiment Station will assume responsibility for detection and appraisal surveys, and an intensive study of the silvicultural and overall ecological factors that may be involved in the blight's spread, and possible control. Funds to carry out this unified attack on the problem will be pooled from the resources of the forest industry, and the state and federal agencies concerned.

Forest Soils Committee Meets

The winter meeting of the Forest Soils Committee of the Douglas-Fir Region was held at the Weyerhaeuser Research Center, Centralia, Wash., January 28.

Dr. Stanley Gessel, secretary, reported that all copies of the committee's publication, *An Introduction to the Forest Soils of the Douglas-Fir Region,* had been sold or ordered.

Various committee members reported on research studies and forest soil survey activities under way by agen-

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NEW ACCESS ROAD OPENS WAY FOR FIRST LARGE SALE OF LODGEPOLE IN DEERLODGE NATIONAL FOREST

On January 15, last year, Naranche & Konda Construction Co. started building 7.4 miles of timber access road for the U. S. Forest Service in the Philipsburg Ranger District, Deerlodge National Forest, Montana. This Butte contractor had been awarded the job with a bid of $110,000. The job involved clearing timber, grading, graveling and drainage for a 14-foot-wide road to EE14 specifications. Earthmoving yardage totaled about 90,000. The job, completed in midsummer, cleared the way to reach large stands of lodgepole timber in the Green Canyon area. The first sale, held in May last year, was for 20,000,000 bd. ft.

Mainstays of production for Naranche & Konda on this job were two CAT* D8 Tractors and a No. 12 Motor Grader. The new D8 was equipped with a No. 8S Bulldozer, while its older brother was matched with a No. 80 Scraper. Materials handled were dirt and rock, with the older unit hauling and the new one doing such chores as push loading, installing a steel culvert pipe and spreading the material dumped on the fill. The units worked 8 hours a day, 6 days a week, with a minimum of down time. Operator Edward A. Nelson made this comment on the new D8's performance: "The torque converter is good for pushing. It gives steady power. It's good for 'dozing, too."

After digging out the ditch, this D8-No. 8S Bulldozer unit eases material up to the culvert. Hydraulic steering clutches provide positive control for precise maneuvering.

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Private & Industrial

H. R. Glascock New Forest Counsel for Western Forestry and Conservation Association

Effective April 1, Hardin R. Glascock, Jr. assumes the position of forest counsel for Western Forestry and Conservation Association with offices in Portland, Ore.

Mr. Glascock brings to the association more than ten years of experience in the Pacific Northwest in logging, forest management, fire prevention, and tree farm operation.

He obtained his forestry degree in 1947 from the College of Forestry, University of Washington. He served as land manager for Bloedel Timberlands Development, Inc., Seattle, specializing in survey and forest inventory work, until he became district forester for the Industrial Forestry Association in 1951.

George B. Amidon Is New President of APA

George B. Amidon was elected to the position of president of the American Pulpwood Association at a meeting of the Board of Directors February 18, according to an announcement by W. S. Bromley, executive secretary of the association. Mr. Amidon becomes the 11th president of the American Pulpwood Association since its formation in 1934. He succeeds L. A. Whittle, of the Brunswick Pulp and Paper Co., Brunswick, Ga., 1956-1957 president.

Mr. Amidon has been director of woodlands for the Minnesota & Ontario Paper Co. since 1956. He is an alumnus of the University of Minnesota's school of forestry, graduating in 1936, and joined Mando in 1944 coming from the U. S. Forest Service Lake States Forest Experiment Station at St. Paul.

The following members of the board were elected vice presidents of the association: L. J. Kugelman, International Paper Co., New York City; A. G. Curtis, Gaylord Container Corp., Division of Crown Zellerbach Corp., Bogalusa, La.; and D. E. Hess, Glatfelter Pulp Wood Co., Gettysburg, Pa.

Kimberly-Clark Positions Announced

J. B. Millar has been named manager of woodlands for Kimberly-Clark Corp. The announcement was concurrent with the retirement February 1 of R. W. Lyons who, as vice president in charge of woodlands for the company, has been associated with Kimberly-Clark or Canadian affiliates since 1928.

Mr. Millar, a native of Canada and a graduate of the University of Toronto from which he received a master's degree in forestry, joined the associated company, Spruce Falls Power and Paper Company, Ltd., Kapuskasing, Ontario, in 1931. He has been chief forester for Kimberly-Clark and assistant to the vice president in charge of woodlands.

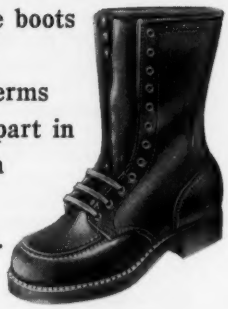
Mr. Millar has announced appointment of L. E. George, management forester, to the position of chief forester. Mr. George, a native of Uniontown, Pa., and a graduate of Pennsylvania State University, joined Kimberly-Clark's woodlands division in 1945. As management forester for the corporation, he has been concerned with forest inventories and management plans.

Olin Mathieson Forms Woodlands Department

The formation of a woodlands department in the Forest Division of Olin Mathieson Chemical Corp., headed by Travis MacClendon, was recently announced by its administrative head, M. H. Collet, transportation and procurement manager for the division.

MacClendon was formerly forestry

Boots! Boots! Boots!



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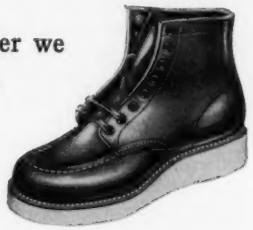

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ACT TODAY — THE SPECIAL ENDS MAY 31

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manager and was in charge of Olin Mathieson's forestry program covering 500,000 acres of timberland. The office of woodlands manager consolidates forestry and wood procurement into the one department.

Other promotions announced by Collet include E. A. Freeman, forestry manager, and Ralph Law, procurement manager. Law had been assistant procurement superintendent and Freeman was assistant forestry manager.

D. W. Robinson, formerly pole superintendent, was appointed staff forester in charge of forest research.

Don Walsh, who had been logging superintendent of the Winnfield Tract, was named to assume duties as an area wood procurement superintendent.

International Forms Preserving Division

In order to provide more complete utilization of all of its forest resources, International Paper Company has formed a Wood Preserving Division, it has been announced by Richard C. Doane, president.

C. V. Holbrook, who was vice president of the former Long-Bell Lumber Company prior to the company's merger with International in November 1956, has been named general manager of the new division.

The new division will operate five modern wood preserving plants in the South and the Northwest. Products include posts, utility poles, piling, railroad ties, and various kinds of timbers and lumber that are pressure-treated with chemicals to resist decay and insect attack.

Norman Jacobson Retires

Norman G. Jacobson retired recently as chief forester and tree farm manager for the St. Paul and Tacoma Lumber Company, Tacoma, Wash. Named as his successor is Edwin S. Sedlacek, tree farm manager since 1955.

Mr. Jacobson has opened an office as consulting forester in Tacoma and will specialize in forest management, protection, timber and land appraisal, taxation, and forest policy.

Union Bag-Camp Corporation To Award Scholarships

Three four-year scholarships enabling young Georgians to study forestry in college are being offered again this year by Union Bag-Camp Paper Corporation, Savannah, Ga.

Each of the three grants is worth up to $1,000 a year for four years. They will be awarded on a competitive basis to high school graduates who are residents of Georgia, and will cover the college year beginning next fall.

Education

Neil Hosley To Head New Forestry School at SIU

Neil W. Hosley, Montana State University professor of forestry and former head of the University of Connecticut Forestry Department, became chairman of the Southern Illinois University Department of Forestry when his appointment was approved in January by the SIU Board of Trustees. He will begin his duties at SIU on June 15.

Dr. A. B. Caster, chairman of the SIU Plant Industries Department in the School of Agriculture, has been acting chairman of the Forestry Department which initiated a four-year Bachelor of Science degree program in forestry on January 2.

Dr. Hosley has been a teacher and administrator in the fields of forestry and wildlife management since 1925.

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He obtained his M.F. degree from Harvard University in 1925 and his doctorate from the University of Michigan School of Forestry in 1938.

Before joining the Montana State faculty last fall, Dr. Hosley was dean of the University of Alaska.

Oregon State Holds Annual Fernhopper Day

Forestry students, professors, alumni, and friends of Oregon State College School of Forestry gathered on the Corvallis campus February 22 for the school's annual Fernhopper Day.

Highlights of the day's activities were alumni meetings and open house at the Forestry Club Cabin. DeWitt Nelson, director of the California Department of Natural Resources, delivered the address at the banquet which closed the day's proceedings.

Ray Schaaf was general chairman for the event.

Three Join Forestry School Staff at Syracuse

Dr. Hardy L. Shirley, dean, State University of New York College of Forestry, Syracuse, has announced appointment of three new members of the college's research staff.

Dr. Philip Luner, research associate, Department of Pulp and Paper Technology, will conduct physical chemical studies basic to the chemistry of pulping and pulp purification. He will work with a research team jointly sponsored by the college and the Empire State Paper Research Associates, Inc. Before joining the college staff, Dr. Luner was with the Sulphite Pulp Manufacturers' Research League.

Dr. Renata G. Marton, formerly with the University of Vienna, has also been appointed research associate in the Department of Pulp and Paper Technology. She will conduct studies in organic chemistry with the ESPRA research team.

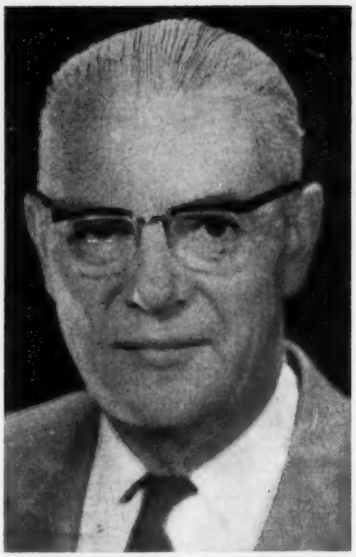
Dr. Morton Litt, a new research associate in the Department of Forest Chemistry, will work with Dr. Michael M. Szwarc, research professor of physical and polymer chemistry.

Clemson Adds Two to Faculty

Bingham M. Cool and Charles O. Minor, formerly assistant professors of forestry at Alabama Polytechnic Institute and Louisiana State University respectively, are new members of the Clemson College forestry faculty.

Both will have duties of associate professor and associate forester.

Dr. Cool is a 1940 graduate of Louisiana State University, with a master's degree in forestry from Iowa State College in 1941. He received his Ph.D. in forestry from Michigan State in 1956. Dr. Cool spent four years in forestry work in the South before entering the field of education in 1949.



NEIL W. HOSLEY

Professor Minor is a 1941 graduate of Iowa State, with a master's degree in forestry from the Duke School of Forestry in utilization the following year. He has worked as an industrial forester and was formerly assistant professor at the School of Forestry, Louisiana State University.

The Clemson forestry department, headed by Dr. Kolman Lehotsky, was established as a separate department in 1956, and initiated a full four-year curriculum last September.

Forest Soils Conference To Be Held

A panel of soil scientists and foresters is being brought together for a North American Forest Soils Conference to be held at Michigan State University, September 8-11, 1958. Sponsored by the Forestry Department, the Soils Science Department, and the College of Agriculture, the 3-day meeting will deal with: soil and the distribution of vegetation; soil and forest management; tree nursery soil management; microbiology of forest soils; analytical methods for soil-forest relationships; soil-water relationships; and soil classification units and forest site indices.

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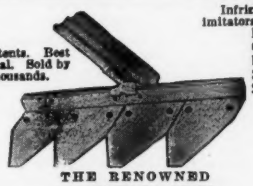
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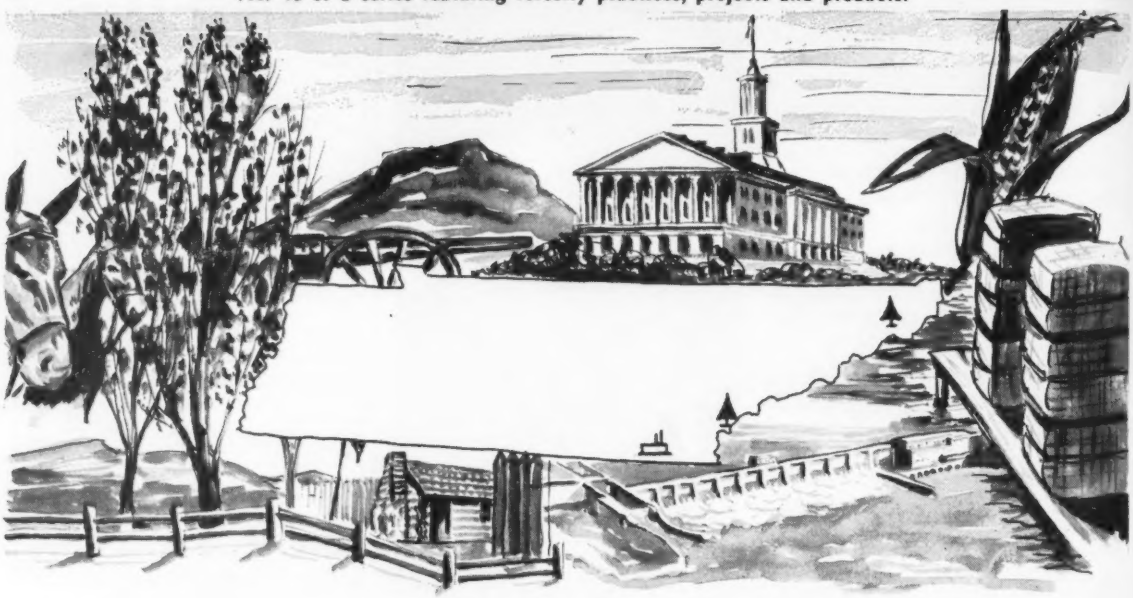

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Tennessee —Oak Flooring Center of the World

Nowhere is there a greater diversification of tree species than in Tennessee. On the crest of the majestic Smoky Mountains in East Tennessee one finds the Canadian types of tree growth. In the rich bottom lands of the famed Mississippi and its tributaries in West Tennessee are the river bottom hardwoods. The areas between have the Appalachian hardwoods, mixed pine and hardwoods and the renowned, aromatic Tennessee red cedar.

There are few single extensive holdings of forest lands in Tennessee. The federal government is the largest single owner with a total of a million acres in the Cherokee National Forest, in the Great Smoky Mountains National Park, in TVA lands and several military establishments. The State owns some 300,000 acres in State Forests, State Parks, Game Management areas and institution lands. The total area of forest land in the State is 12,607,000 acres, held by more than 180,000 individual owners.

Tennessee is making phenomenal progress in putting its million acres of idle lands, mostly worn out farm lands, back to work growing wood. Five years ago 12.2 million trees were planted in the State, 2.8 million from the State's nursery and 9.4 million supplied by TVA. This year some 60 million will be planted—12 million from the TVA and the rest from the State nursery. The goal is 100 million a year.

All but 1½ million acres of the total forest area in the State is under fire protection. Seventy counties participate in the protection program by voting funds to help defray its cost. At the present rate of expansion all of the counties will be in the program within three years. Perhaps in no other State is there greater cooperation and harmonious working relationships among all public agencies whose programs are concerned with natural resource conservation. Likewise the forest products industries in the State have joined forces to make two high quality trees grow where only one or none grew before. The widespread, active public interest in the State's forest conservation program is reflected in increased forestry appropriations made by each Legislature in recent years. In forest management too, significant progress is being made.

Tennessee is taking steps necessary to guarantee not only sufficient raw material for its present 360 million dollar a year forest industries employing 43,000 people, but for a forest economy three times as great as at present. More and better timber on the watersheds will guarantee clearer water and steadier flowing streams emptying into the State's many man-made reservoirs. Soil erosion will be minimized and all the other forest benefits will accrue to make Tennesseans even prouder of their forest heritage.

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Frank Heyward Greeley Lecturer

The service of Frank Heyward, Jr., as the 1958 Colonel William B. Greeley Lecturer in Industrial Forestry at the University of Washington was announced by Dean Gordon Marckworth of the College of Forestry. The lectureship was established in 1956 by the Industrial Forestry Association as a memorial to the late Colonel William B. Greeley.

Mr. Heyward is director of public relations, Gaylord Container Corporation, Division of Crown Zellerbach Corporation, Bogalusa, La.

A series of three lectures were given by Mr. Heyward on February 27, 28, and March 1, dealing with the development of industrial forestry in the South.

Whipple Appointed Head of API Forestry Unit

The appointment of Sherman Duane Whipple as associate forester with Alabama Polytechnic Institute's Agricultural Experiment Station was announced by Ralph B. Draughon, API president. He will be in charge of the station's forestry unit at Fayette.

Mr. Whipple, a native of Conneaut, Ohio, attended Ohio State University and University of Michigan, receiving a master's degree in forestry in 1947. He was assistant professor of forestry and superintendent of forests at Berea College.

Public

JESS L. BEDWELL

Forest Disease Chief Retires

Jess L. Bedwell, chief of forest disease research at the Pacific Northwest Forest and Range Experiment Station, retired January 31 after more than 41 years of government service.

Named as Dr. Bedwell's successor is Dr. Thomas W. Childs, who has served in the same division at Portland for the past 28 years.

Dr. Bedwell has been in forest disease research at Spokane, Wash., at Washington, D. C., and at Portland since 1924, when he joined the Bureau of Plant Industry's forest pathology division. He has been in charge of the division at Portland since 1935.

He holds a B.S. degree from the University of Idaho forestry school, an M.S. degree from Oregon State College, and a Ph.D. degree from Yale University.

Dr. Childs has been associated with the forest pathology division at Portland since 1929, except while studying for an advanced degree in the East and while serving in the Army in World War II. He was graduated from Oregon State College forestry school in 1929 and earned a Ph. D. degree from the University of Pennsylvania in 1936.

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JAMES K. VESSEY

J. K. Vessey Named Regional Forester at Atlanta

James K. Vessey, assistant regional forester of the U. S. Forest Service Region 9, Milwaukee, Wis., has been promoted to regional forester for the Southern Region with headquarters at Atlanta, Ga. He succeeds C. Otto Lindh who retired February 28 after 33 years of service.

Mr. Vessey has been in charge of cooperative work with states and private landowners in the North Central Region since 1956. Before that for six years he was in charge of information and education activities for the Northern Region at Missoula, Mont.

Born in Mont Clare, Pa, Mr. Vessey graduated from Pennsylvania State University in 1925 with a BS in forestry. He went into private industry and was then first employed by the Forest Service as an assistant on the Allegheny National Forest in Pennsylvania in 1933.

For his outstanding contributions to conservation Mr. Vessey in 1956 was one of 10 professional conservationists in the country to receive a Nash Conservation Award.

C. OTTO LINDH

C. Otto Lindh Retires

Retirement February 28 of C. Otto Lindh, formerly U. S. Forest Service fire control chief from 1939 to 1946 in the Pacific Northwest Region, has been announced by Richard E. McArdle, chief of the Forest Service.

Lindh, a native of Battleground, Wash., and a graduate in forestry from Oregon State College in 1927, left the Pacific Northwest Region in 1946 to become assistant regional forester in charge of timber management in the Southwestern Region. Three years later he was promoted to regional forester and occupied this position until transferred to Atlanta, Ga., in 1955 to be regional forester.

A veteran of 33 years of service, Lindh worked up through the ranks of the Forest Service as assistant ranger, ranger, assistant forest supervisor, and assistant regional forester in the Pacific Northwest.

Lindh's successor is James K. Vessey, formerly assistant regional forester in the North Central Region.

Wellner New Division Chief at Intermountain Station

Charles A. Wellner of Spokane, Wash., has been appointed chief of the Division of Forest Management Research at the Intermountain Forest and Range Experiment Station, according to announcement by Reed W. Bailey, director.

Mr. Wellner has been leader of the Inland Empire Research Center at Spokane since 1948, when it was organized. He has been active in establishing the North Idaho Forest Genetics Laboratory at Moscow, Idaho, in cooperation with the College of Forestry at University of Idaho.

Mr. Wellner has been leader of the the College of Forestry, University of Idaho, in 1933, and received the degree of Master of Forestry at Yale. Except for service as aerological officer in the U. S. Navy from 1942 to 1946, he has engaged in Forest Service research since 1933.

R. Z. Callaham to Head Research Center

Dr. R. Z. Callaham, geneticist at the California Forest and Range Experiment Station, will become leader of the Inland Empire Research Center of the Intermountain Forest and Range Experiment Station about May 1, according to announcement by Reed W.

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Bailey, director. Dr. Callaham succeeds Charles A. Wellner, recently promoted to chief of the division of timber management research at the Intermountain Station in Ogden.

Dr. Callaham entered federal service in 1949 as a member of the Bureau of Entomology and Plant Quarantine. In 1953 he joined the California Forest and Range Experiment Station. He graduated from the University of California School of Forestry in 1949 and received his doctoral degree in botany from the University of California in 1955.

Ellstrom Transfer Announced

Transfer of Raymond W. Ellstrom from district ranger of the Illinois Valley district, Siskiyou National Forest, to a position in the Division of Timber Management in the Regional Office of the U. S. Forest Service, Portland, Ore., has been announced by Regional Forester J. Herbert Stone.

Ellstrom began his Forest Service career with the Northeastern Forest Experiment Station, New Haven, Conn., in 1938.

A native of St. Paul, Minn., Ellstrom graduated from the University of Minnesota in 1938 with a B.S.F. degree.

Minckler Returns to Forest Service Duties

Dr. L. S. Minckler, silviculturist at the Carbondale Forest Research Center, U. S. Forest Service, has resumed his research duties after a leave of absence during which he taught in the School of Natural Resources, University of Michigan, for one semester.

Minckler replaced Dr. Stephen H. Spurr who is on temporary leave from the Department of Forestry under a National Science Foundation Fellowship. While at Michigan Minckler taught the course in silvics and a graduate course in advanced silviculture.

Intermountain Station Has New Meteorologist

Donald M. Fuquay of Missoula, Mont., has been appointed research meteorologist for the Intermountain Forest and Range Experiment Station according to announcement by Reed W. Bailey, director. Mr. Fuquay will be principal staff assistant to Jack S. Barrows, chief of the Station's division of forest fire research at Missoula.

Mr. Fuquay has been research meteorologist with the Munitalp Foundation, Inc.

Forestry Employment

S.A.F. members are privileged to insert one 60-word advertisement in this column without charge. Forest industries desiring to employ foresters may insert advertisements at the rate of $4 per column inch. Copy must be received by the end of this month for an advertisement to appear in the issue after next.

Obviously, the Society cannot assume responsibility beyond making it possible for prospective employee and employer to enter into negotiations.

Position Wanted

Summer employment wanted. Age 18, Eagle Scout, high school graduate. Enrolled at Purdue University forestry school. Wants outdoor forestry work for summer. Willing to do any kind of work for experience.

Address Clifford Jacobson, 4222 Broadway, Indianapolis, Ind.

Boise-Ogden Foresters Shifted

George E. Lafferty, fire control officer on the Boise National Forest since 1956, has been promoted to assistant supervisor, it was announced by K. D. Flock, forest supervisor.

Replacing Mr. Lafferty will be William E. Murray, regional staff forester in the Division of Fire Control and State & Private Forestry for the Forest Service at Ogden, Utah.

Products & Equipment

Business Seminars to be Offered

Business techniques which can assist conservation contractors and excavating contractors to more profitable operations will be presented at a series of intensive business seminars to be conducted in 1958 in half-day sessions at Caterpillar dealers throughout the country. The business seminars are designed to acquaint more fully the normally small contractors with sound business practices.

Subjects to be covered in the seminars will include machinery owning and operating costs, machine operation and application, production comparisons, service, parts, advertising, and job opportunities.

Conceived by Caterpillar Tractor Company sales development specialists, the business seminars are aimed at counteracting the major causes of contractor failure. Management practices including business records, owning and operating costs, and bidding methods will all be discussed.

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With 2-way radio, the logging superintendent is in immediate touch with each of his key personnel all day long. Problems in safety, personnel welfare, breakdown, landing clog-ups, supervisory decisions and forest protection can be handled on the spot. If each mobile unit saves only two minutes an hour, Motorola radio pays for itself. And in times of emergency, the 2-way radio is invaluable.

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IF YOUR DRIVER SAVES 2 MINUTES AN HOUR WITH RADIO

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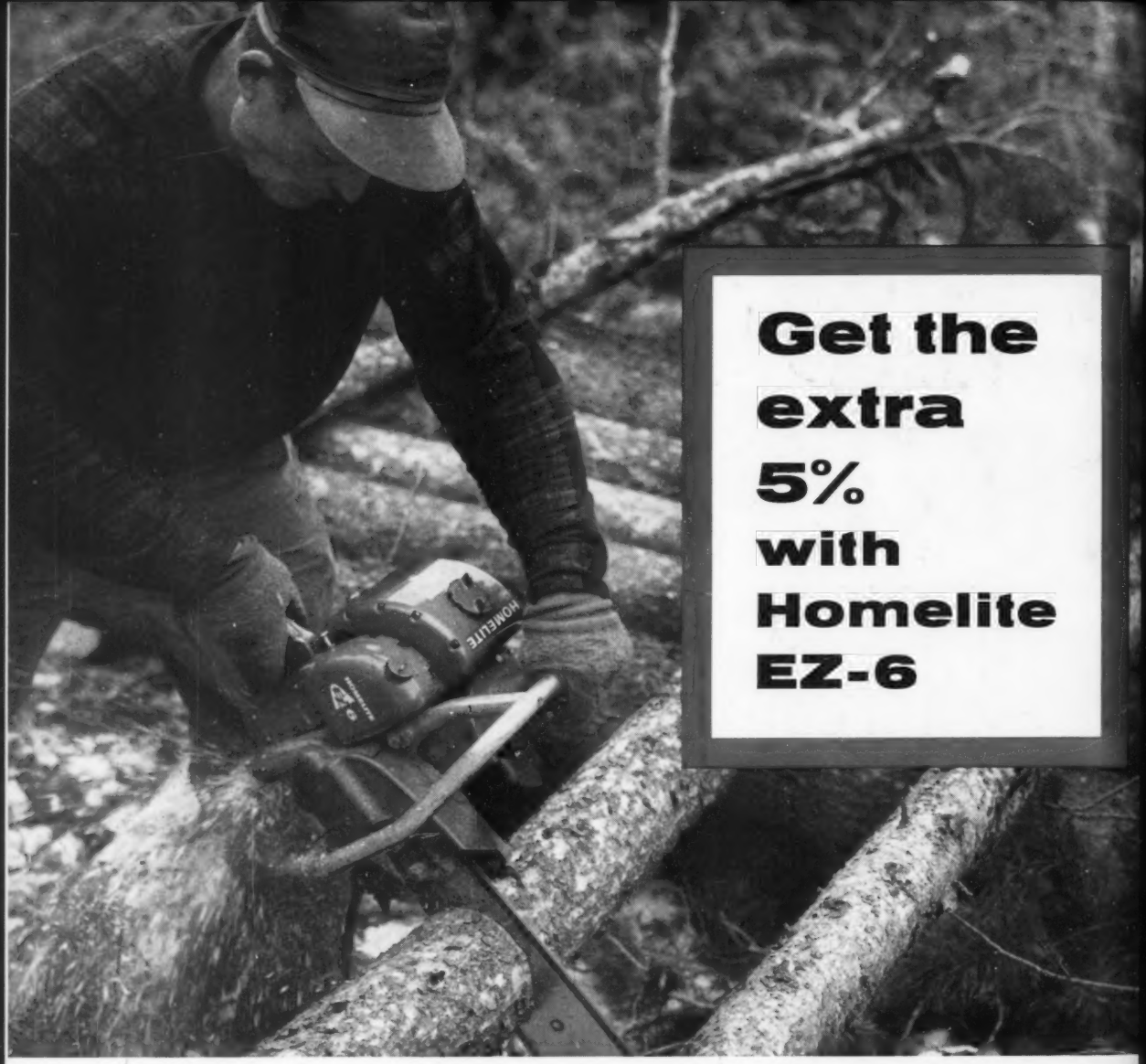

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